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Case study report

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CASE STUDY REPORT

Editors: Sverre J. Herstad

Inside the black box of multinationals:

Exploring the challenges and implications of Nordic corporate internationalisation

DOMUS case study report

Edited by Sverre J. Herstad

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Abstract:
This project has investigated outward foreign direct investments from the Nordic economies, and analysed the role domestic multinational companies play in their respective Nordic home economies. The project consisted of a desktop study of existing research, a quantitative study of FDI flows and the innovation behaviour of multinationals, and a qualitative analysis based on interviews conducted with leading managers, researchers and owner respondents in 17 Nordic domestic multinationals.

The following report presents the qualitative analysis papers written on the basis of these interviews.

Through the project as a whole, valuable insights into multinational corporate behaviour and strategy have been gained. It explicitly addresses the home-base implications of corporate internationalisation, and provides a theoretical framework for understanding the conditions under which the foreign activities of such companies provide valuable knowledge inputs into the domestic innovation systems of the Nordic countries.

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Executive project summary

The purpose of the project

DOMUS had as its stated objective to *'… study the role of large domestic multinationals (DOMs) in the national innovation system (NIS)'*. Three specific research questions where initially formulated:

1. Identify the factors that influence localization decisions of headquarter functions and other *strategic* (Benito et al 2002) activities, including R&D

2. Map the effects such companies have on the overall capabilities of their respective national innovation systems

3. Investigate the effects a multinational presence has on the home activities of DOMs

Corporate internationalisation raises critical questions concerning the conditions under which activities abroad may generate knowledge spill-over domestically – into the home-base NIS; and the conditions under which the knowledge intensive parts of corporate activities, and consequently the productive knowledge base, over time can be expected to follow simpler operations out the country of origin. These questions are by large unresolved in existing theoretical and empirical research, first and foremost as a result of a lacking theoretical framework (Narula and Zanfei 2005) that incorporate sound perspectives on both localizational decisions under different technological conditions (Andersson and Friberg 2005, Herstad et al 2006b); and the workings of the MNE as a research, development and innovation network in its own right.

Method

The research strategy of DOMUS has therefore to a large extent been explorative and qualitative; i.e. based on desktop study of existing research and analysis of data gathered through interviews in selected, Nordic DOMs. This has been supported by qualitative analysis based on Community Innovation Survey, conducted through the DOMUS predecessor FOTON (Ebersberger and Lööf 2005) and specifically for DOMUS (Ebersberger 2006, in Oksanen and Rilla (eds) 2006). There are several reasons why a qualitative research strategy has been chosen; the most important one being a combination of quantitative evidence readily available from FOTON and the need for explorative research to feed into general theory development. It is our clear opinion that, given the existing state of affairs at the research frontier, in-depth firm level analysis with the purpose of making *analytical* generalizations concerning basic socio-economic forces at play (Yin 1984, OECD 2006:65) must feed into general theory development which only then should be further refined and empirically validated using quantitative methods. What qualitative research lacks in empirical representativity it by far compensate for by

allowing direct dialogue with representatives of the phenomena in question. It allows us to avoid 'black boxing' the core actors, firms. This particularly applies when dealing with the generation, flow and accumulation of non-measurable resources – knowledge.

The project resulted in three different research module reports, presenting in detail the findings of each research module, and a synthesis report which draw on all the different modules in order to answer the research questions initially formulated.

Main conclusions

Concerning the first question, the project identified market access to be the main, overall driver of corporate internationalization. The project further point out that access to cheap factors of production at least historically appears to have been a driving force of fairly low importance. This conclusion, however, neglect the large diversity in motives and requirements that exist between different sectors.

The project further questioned the extent to which the internationalization of R&D and other knowledge-intensive activities are driven by the properties of the places in which MNEs invest (the so-called localization-specific advantages highlighted in the traditional understanding of MNEs). This question is raised on the background of mergers and acquisitions being the dominating mode of entry into a new market. Alternatively R&D abroad, in an acquired firm, could be considered an outcome of the in-house competencies of that acquired firm, and thus not a localization decision but a localization outcome. Evidence from interviewed companies clearly support the project in concluding that the internationalization of R&D, and in particular what is traditionally considered localization decisions, is a much more complex and differentiated process than what is assumed in the traditional theory of the multinational enterprise. As this assumption has been guiding most existing studies and policy, further research is needed to provide a clear answer to this question. This research need to account for industry branch differences between knowledge bases and consequently differences in availability of relevant knowledge in different places.

Answering research question number two, the project emphasized that domestic multinationals predominantly are key actors in their national innovation system, and hence that their activities have a large impact on these. This reinforces the relevance of research question number three, on which the project put its main emphasis.

On research question number three the project concluded that DOMs serve as global knowledge pipelines for the domestic innovation systems, but predominantly do so within sectors and technological fields in which the NIS is already specialized. These are the sectors in which the different economies are most likely to develop strong DOMs, the sectors on which those same DOMs are most likely to develop strong in-house competencies domestically while remaining embedded in linkages to external, domestic NIS actors – and the sectors and technological fields in which NIS as a whole most likely will be able to absorb externalities.

Research implications

The project propose a set of complementary studies to be conducted in order to utilise and further refine the theoretical perspectives developed by DOMUS, and to build on this to significantly increase our understanding of the dynamics and implications of corporate internationalisation. Specifically the project also suggested conducting a large study of the role of Nordic multinationals in Nordic economic integration.

Foreword

DOMUS – Innovation and the role of domestic multinationals – was conducted in the form of three research modules designed to provide complementary insights into the phenomena in question – Nordic corporate internationalization and the implications of this for the domestic innovation systems (NIS) of international firms. Module 1 consisted of a desktop study of existing research at the national levels (Friberg (ed) 2006); module 2 mapped DOM activities in the Nordic countries (Rilla and Oksanen (eds) 2006) and provided more in-depth quantitative analysis (Ebersberger 2006). This module 3 paper will present the analysis based on data gathered through interviews in selected Nordic DOMs.

The research strategy has to a large extent been explorative and qualitative; i.e. based on desktop study of existing research and analysis of data gathered through interviews in selected, Nordic DOMs. It follows from this that the project owes a lot to those companies and respondents who have been willing to discuss the issues in question with the DOMUS research group.

There are several reasons why a qualitative research strategy has been chosen; the most important one being a combination of quantitative evidence readily available from FOTON (Ebersberger and Lööf 2006) and the need for explorative research to feed into general theory development. It is our clear opinion that, given the existing state of affairs at the research frontier, in-depth firm level analysis with the purpose of making analytical generalizations concerning basic socio-economic forces at play (Yin 1984, OECD 2006:65) must feed into general theory development which only then should be further refined and empirically validated using quantitative methods. What qualitative research lacks in empirical representativity it by far compensate for by allowing direct dialogue with representatives of the phenomena in question. It allows us to avoid 'black boxing' the core actors, firms. This particularly important when dealing with the generation, flow and accumulation of non-measurable resources – knowledge.

The purpose has not been to conduct full-fledged case studies of the different interviewed companies, but qualitative data analysis aimed at increasing our understanding of corporate internationalization as a phenomenon, its challenges for corporations and national economies – and thus dynamics and possible implications, primarily at the national level. Case studies are used as a key element in an exploratory rather than intensive research strategy (see contribution by Jónsdóttir, this volume). Hence, the different country case study papers presented in the following will not provide comprehensive analysis of the histories and internationalization patterns of the different case companies. Any attempt to do these companies full justice within the resource constraints of DOMUS would not have proven fruitful, and would also have been a significant deviation from the purpose of the project as a whole.

Interviewed companies are not empirically representative for any larger population of firms; nor have they been selected for that purpose. Rather, they have been selected based

on expected information richness (Flyvbjerg 1991); their prospects for providing insights into the long-term dynamics of corporate internationalization, and related socio-economic processes within and surrounding domestic multinational corporations. This resulted in case firms being fairly mature experienced international actors within their respective national economies.

Note that the answers given in the conducted interviews not necessarily are reflections of company policy or official statements, but merely the respondents' view of the situation for the company in question, interpreted by the interviewer and put into a larger theoretical context.

Norway: Jotun, Kverneland, Tandberg Data, Aker Yards and Wilh. Wilhelmsen Group

By Sverre J. Herstad, NIFU STEP

Introduction

The companies chosen as data sources for qualitative analysis of Norwegian corporate internationalization are Aker Yards, Jotun, Kverneland, Tandberg Data and Wilhelmsen Group. Data from these was gathered through 1-3 interviews in each company, with respondents ranging from employee board representatives through technology officers, managing directors and main owners. Background material and general facts was gathered through newspapers, web pages and publications, and interviews where used only to discuss key issues of interest.

The case companies

Aker Yards has a history that dates back to 1841, and is now majority owned by Norwegian Aker Group, the latter majority owned by the holding company of Kjell Inge Røkke. It defines itself as a high-end international shipbuilding group focusing on sophisticated a) cruise vessels and ferries, b) merchant fleet vessels and c) offshore and other specialized vessels. Following its recent agreement with French industrial group Alstom to purchase its marine division, it will become the fourth largest ship-builder in the world. Excluding the Chantiers de l'Atlantique and Saint-Naizires Yards of Alstom Marine, with in excess of 3000 employees, Aker Yards in 2004 had a turnover of NOK 12.5 billion and employed approximately 13 000 people world-wide. This includes 4000 employees at Aker Finnyards (Finland), and 2400 employees at Aker Ostsee (Germany). It also holds the responsibility for operating the former Kvaerner Philadelphia Shipyard, formally owned by Aker Group subsidiary Aker American Shipping.

Aker Yards develop and manufacture investment goods aimed at professional users, and user-producers interactions are very dense. Technologically, the market is mature and thus characterized by few radical innovation and well-established development paths. Given the life-span of the product in question, the large investments and thus capital costs involved, and the sensitivity of customer operating costs towards factors such fuel economy and efficiency in harbor operations, the main window of opportunity for innovation lies in the ability of yards to combine cost-efficient, high-quality production with design dedicated to specific industrial shipping customer needs.

As Aker Yards, paint and coatings company Jotun is also a product of what is commonly refereed to as the Norwegian maritime cluster. The backbone of Jotun has been, and still to a certain extent is, maritime paint systems. According to UNCTAD (2005) it is one of the ten largest Norwegian domestic multinationals, with a turnover exceeding 6 billion NOK and 4750 employees in 36 production and development facilities world-wide. Of these are 130 employed at the R&D lab in Sandefjord, Norway, and only 70 directly employed as R&D staff abroad. It is still majority owned by the founding Gleditsch family, with Norwegian industrial conglomerate Orkla holding a 40% position. Jotun serve professional and consumer markets1, the former technologically demanding, the latter increasingly infiltrated by low-cost paints and both subject to strengthening environmental regulations and varying demands in different geographical segments. This factors in sum forces significant investments in long-term basic R&D, and in market adaptation.

Kverneland Group develops and produces specialized agricultural and vineyard implements such as ploughs and harvesters, and is, if excluding so-called full-liners2, the largest international actor in this industry. The Group operates in professional user markets that are very geographically and functionally differentiated3, and have shown to be very cyclical4. It has a 15 % share of the total market for agricultural implements in Europe, and a 40% share of the world market for vineyard implements. It operates in 20 countries, employing approximately 2800 people, export to 60 countries and describes itself as one of the most internationalized mid-sized companies in Norway. 80% of employment is found outside Norway, and 98% of turnover stem from international markets. In 2004 the turnover was 500 million EURO. Known brand names controlled by the group include Kverneland (soil preparation, Norway), Taarup (grass harvesting and feeding, Denmark), Rau (soil preparation, seeders and pesticide sprayers, Germany), Vicon (grass harvesting and feeding, fertilizers, Netherlands), Maletti (Italy), Gregoirè (grape harvesters, France), Lagarde (choppers/road maintenance, vine conditioning

[1] Jotun *Coatings* develop and produce heavy-duty anti-corrosion systems for marine and industrial applications, and has production facilities in Australia, Finland, Italy, China Singapore, Spain, Great Britain, South Africa, South-Korea, Turkey and the US. This professional user market is characterized by fairly dense user-producer interaction and strong requirements as to durability. Jotun *Decorative* serve professional and do-it-yourself markets in Scandinavia with outdoor and indoor domestic paint and wood protection products from the Jotun base in Sandefjord, Norway. Jotun *Paints* serve similar markets in the Middle East and South Asia, including corrosion-inhibiting paints for local marine and industrial markets. This division has production units in United Arab Emirates, Saudi-Arabia, Egypt, Indonesia, Malaysia, Oman, Thailand and Vietnam. Finally, Jotun *Powder Coatings*, headquartered in Dubai, is a leading international developer and producer of thermosetting powder coatings used for protecting and decorating mass-produced industrial commodities.

[2] E.g. companies also producing tractors

[3] Implements must be dedicated to the specific conditions of use in different national or regional markets. Such specific conditions include the structure of the farming industry – from industrial farms in e.g. the US to small-scale farming in Ireland or Norway – and climatic as well as soil conditions

[4] This willingness has been shown to fluctuate with international agricultural produce prices, in turn fluctuate with weather conditions during critical periods of the season, and with changes in the political frameworks surrounding farming.

equipment, France), Vinestor (vineyard equipment, Australia) and Accord (seeders and fertilizers, Germany).

Kverneland was established in 1879, and remained in family control until stock-market flotation in 1983 triggered a long period without committed shareholders. Starting in 2000, and following a collapse in Kvernelands market capitalization caused in part by huge restructuring and integration costs in the wake of its international expansion, Norwegian Umoe Group, controlled by Jens Ulltveit Moe and his family, increased its shareholdings up to the 31.68 percent controlling share held today. Umoe has business activities that include marine transportation, maritime equipment industries, shipyards, oil & gas services, catering services and IT and telecoms businesses.

Tandberg Data is an international developer and manufacturer of professional information storage products, with a main focus on tape-based products but extending into disc-based systems. Until 1996 it also had a LCD projector unit, which was de-merged and floated separately under the name ASK5. It is headquartered in Oslo, and has subsidiaries in the US (Tandberg Data Corp.), France, Germany, Norway (Tandberg Storage, and its subsidiary company O-mass), Singapore and Japan, as well as affiliate offices in India and China. It had an export share of 98% in 2004, reaching a turnover of USD 106 million and employing 204 people world-wide. Employment at the Norwegian HQ was 84, in addition to 45 employees at the affiliated and co-located technology development company Tandberg Storage (se below)6. From 1979 to 1990, German industrial conglomerate Siemens held a 58 % share of Tandberg Data7. It is now stock-market floated, without major shareholders. In 2004 it generated approximately 28% of its revenues through OEM contracts with corporations such as Dell, IBM and Fujitsu Siemens. The remaining income is generated through direct sales to other professional users, mainly private companies or public institutions such as e.g. universities.

Maritime logistics and services group Wilh. Wilhelmsen (hereafter WW) comprises maritime activities ranging spanning a wide range, but with a main emphasis on international liner activity through Wallenius Wilhelmsen Logistics (WWL – owned 50% by WW), EUKOR Car Carriers Inc (owned 40%) and American Roll-on Roll-off Carrier (ARC – owned 50%). Approximately 150 of the 485 car-carriers in the world are controlled by WW and its partners. Other activities within the group include related logistics services, partly through a series of joint ventures and subsidiaries. These are Korea-based Glovis (owned 25%), France's Compagnie d'Affrètement et de Transport SA (owned 40%), and the US companies Distribution and Auto Service, Inc, American Auto Logistics and American Logistics Network (owned 50%).

In 2004 WW acquired Unitor, a ship support service company already one of the larger Norwegian domestic multinationals (UNCTAD 2005). This resulted in the establishment

[5] Only to be purchased and closed down by US competitor Proxima.
[6] Tandberg Storage was created through a de-merger from Tandberg Data. The latter control 34,9 % of the shares in the former, the main business of which are developing and manufacturing storage equipment for the small and medium sized enterprises market.
[7] Sold in 1990 when the computer divisions of Siemens and Nixdorf merged.

of Wilhelmsen Maritime Services (WMS) comprised of Unitor and existing service, consultancy and ship design activities within the group. These include Barwill, Barber Ship Management, Barber Marine Consultants, Wilhelmsen Bunkers and Wilhelmsen Insurance Services. The establishment of WMS is stated by the company as an important departure from the traditional ship owning role and towards more knowledge-intensive and higher value added activities.

The main customer base of the linear activity is the car industry, and Hyundai Motor Corporation of Korea still holds a 20% ownership stake in EUKOR. These customers are stated by the group as very demanding; given just-in-time delivery systems for cars precision, reliability and quality in transportation is of key importance. When combined with seasonal and cyclical market fluctuations in demand for cars, huge fixed cost investments in vessels and the short and medium term inflexibility in capacity, this translates into a strong pressure towards optimal use and flexibility in existing capacity, and on the logistics and support infrastructure surrounding the actual running of vessels.

WW remain in control of the founding Wilhelmsen family. The group itself has 13 500 employees, but contribute to the employment of approximately 22 000 people when part-owned companies are included. Only around 400 of these are found at group and divisional headquarters in Oslo. WW has roughly 389 offices in about 72 countries, creating an extensive intra- and inter-group global network.

Company histories and patterns of internationalization

Wilh Wilhelmsen was established 1861 as a brokering business. In 1911 Norwegian Africa and Australia Line was established as a partnership between WW and another Norwegian shipping company, extending the activity of WW into international liner services and by 1914 including destinations such as Australia, Japan, India and China. By the end of the war, WW had expanded into oil tankers and controlled 92 % of the Norwegian tanker fleet. During the inter-war years WW develop a vision of a highly specialised international liner fleet, and the linear activity was expanded.

The post war period was characterised by an ambitious new-build programme, including the development of the roll on- roll off (RO-RO) vessel concept. In 1972-73 five RO-RO vessels built for WW entered service. During the late 1970's WW entered the offshore drilling and service market, and in 1983 it entered into specialised car transportation. The start of the war between Iran and Iraq in 1979 triggered a collapse in the RO-RO market, and the increasingly important offshore market collapsed during the mid 1980s. A serious financial crisis followed, and triggered a restructuring that by the mid 1990s had created a corporate group strongly focused on the car-carrier and maritime services markets. This focus was strengthened further by the Wallenius and Wilhelmsen joint acquisition of the car carrier division of Hyundai Merchant Marine in 2002.

Kverneland was established in 1879 as a local forge, and fuelled growth in its production of ploughs by early implementation of steam-based mass-production techniques and by

early reorientation towards agricultural implements for tractors. By the mid 1950s Kverneland started to look for further expansion opportunities, and developed an acquisition programme focused on acquiring producers of complementary farming implements. In 1973 Kverneland acquired Plovfabrikken Fraugde in Denmark, thus transforming itself into a multinational enterprise. During the 1980s Kverneland acquired several Norwegian entities. Throughout the 1990s it acquired implement producers in Denmark, UK, Germany, Netherlands and Italy. In 2000 the acquisition programme was brought to a hold when the group entered the viticulture market through two acquisitions in France and one in Australia. By the beginning of the new millennium it became increasingly evident that the group was struggling with fundamental problems related to integrating and co-ordinating the new activities. In 2000 alone restructuring costs of EUR 50 million incurred, and the total restructuring costs in the wake of the international expansion is estimated by Kverneland to be in excess of EUR 100 million (Finansavisen May 2006).

The predecessor of Aker Yards, Aker Mekaniske Verksted, was established in 1841 and thus has a long history as Norwegian industrial group. In 1996 Resource Group International, a tax-haven investment company controlled by Norwegians Kjell Inge Røkke and Bjørn Rune Gjelsten, acquired a 30 percent stake in what was then petroleum and construction group Aker. This triggered a battle between RGI and institutional investors led by state pension fund Folketrygdfondet and insurance company UNI Storebrand, both shareholders in Aker. Later the same year Aker and RGI merged, creating Aker RGI. Subsequent restructurings included the establishment and stock-market flotation of Scancem, former Aker cement division; Aker Maritime and Norwegian Contractors. Rumours early emerged that the Aker acquisition and restructuring was part of a larger RGI aqiuisition plan which included then independent engineering company Kvaerner.

The aggressive acquisition-based internationalisation of Kvaerner reached a peak with the 1996 acquisition of UK-based engineering and construction company Trafalgar House. This created one of the largest engineering companies in the world, and the largest shipbuilder in Europe[8]. By spring 1998 it became increasingly evident that the new debt-burdened Kvaerner had severe financial problems, causing a complete collapse in its stock market capitalisation. By October 1998 it was considered to be on the verge of bankruptcy, CEO Erik Tønseth was forced to resign and was replaced by former ABB Oil and Gas CEO Kjell Almskog.

In 2000 Aker Maritime acquired a large stake in Kværner, triggering a power struggle different Kvaerner stakeholders that included employees, the largest Norwegian bank DNB and Russian petroleum company Yukos Oil. This eventually resulted in Aker Maritime gaining control over Kvaerner[9], in turn leading to numerous financial and

[8] In 1997 it also acquires a former navy shipyard in Philadelphia, tempted by prospect of substantial US public support, and renamed it Kvaerner Philadelphia Shipyard.

[9] In 2001, the second largest petroleum producer in Russia, Yukos oil, acquired 21 percent of Kvaerners share capital, positioning itself as the largest shareholder. During November 2001 intense negotiations where conducted between Yukos Oil, Aker Maritime and Kvaerners main banks, and the Yukos scheme to

organisational restructuring operations within the new Aker umbrella. Aker Kvaerner was formally established in April 2004 and included most of the previous Kvaerner businesses providing engineering and construction services, technology products and integrated solutions within industries such as oil and gas, refining and petrochemicals, power generation, pulp & paper and mining and metals. Certain operational activities, mainly former Trafalgar House businesses in the UK, were 'sold' separately as Kvaerner Plc to its management. Aker Yards was established in June the same year as a combination of the remaining shipbuilding activities of Kværner and Aker. A new company, Aker Group, was established as an umbrella for these and other former RGI activities, consolidating the present-day Aker Group structure as one of the largest Norwegian DOMs.

Jotun was established in 1920, as a regional paint retailer serving the large whaling fleet based in southeastern Norway. In 1926 founder Odd Gleditsch acquired a local paint factory, and established Jotun Kemiske Fabrikk A/S as a producer of marine paints and antifouling agents. Jotun later diversified into the market for domestic paints, and with the 1935 acquisition of Vera A/S into vegetable oils10. In 1951 it built a large, new factory in Norway, and an at the time unprecedented large R&D department was established.

In 1959 large petroleum reserves where discovered in Libya, then a peaceful kingdom. This was expected to create rapid economic growth in the region, and triggered a greenfield investment in 1962. The first Asian operation, a paint factory in Thailand, was established in 1968, and throughout the 1970s Jotun acquired or established operations in the UK, US, Dubai and Singapore. Proximity to important maritime activities was most important driving force behind this. The expansion continued throughout the 1980s with the establishment of production facilities in Saudi-Arabia, Malaysia, Egypt, Oman and Turkey. Notable developments during the 1990s include acquisitions in Australia, Canada and the US, a new factory in Vietnam and the establishment of a paint laboratory in South Korea. In 2004 two out of four divisional headquarters (Paints, Powder) was relocated to Dubai. Jotun now has 61 subsidiary companies in 37 countries, out of which 36 are factories located in 22 countries. Jotun also holds significant although minority holdings in licensing companies - e.g. major shipyard supplier Nor-Mali Oy in Finland.

The origins of Tandberg Data can be traced directly back to Tandberg Radio Factory, founded in 1933 and dissolved into several separate entities in 1979. Several other existing companies, notably Tandberg and Tandberg Television, thus share this origin with Tandberg Data, the same applies for dissolved companies such as ASK (LCD projectors) and Tandberg Audio (high-end audio products). Tandberg Data established subsidiary sales and support locations in Germany, France and USA during the 1980's,

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rescue Kværner from bankruptcy by splitting it up into different companies was blocked by Aker Maritime. By mid November Aker Maritime had gained a 25 percent share of Kværner, and after intense negotiations between Norwegian bank DNB and Aker Maritime during the night between November 27th and 28th the battle for control over Kværner was settled once and for all in favour of Aker and its restructuring plan.

[10] Other notable Jotun diversification projects included large-scale pipes made of glassfiber-reinforced polyester (GRP), attempts at developing a closed-environment technology for moulding GRP boats; and the famous 'Snurredassen' dry closet.

and during the 1990s expanded its foreign presence by establishing subsidiary locations in Japan, Singapore, Poland and the UK. The UK and Polish operations are responsible for disc technology R&D, whereas the US operations carry out certain tape technology R&D complementary to Norwegian activities.

National innovation system origins

Thus, it is apparent how the case companies share a distinct Norwegian national innovation system origin, or have emerged out of specialized regional sub-systems which have supported the development of their ownership-specific advantages.

Aker Yards, Wilh Wilhelmsen and Jotun of Norway have a common origin in the national maritime cluster, whereas Kverneland is one of the largest companies to emerge out of the distinct Jaeren mechanical engineering cluster and agriculture region of South Western Norway (Asheim and Herstad 2005). Paint manufacturer Jotun still maritime paints and corrosion inhibitors as a key activity, including products both for maritime vessels and offshore installations, and state that existing maritime and offshore petroleum activities in Norway are a key prerequisite for product development in this area. Wilh Wilhelmsen have historically nurtured tight direct linkages to specialized Norwegian shipping banks, insurance companies, consultancy and certification agencies, and built their land-based administrative and management functions on abundant supplies of Norwegian, experienced sea officers. The Norwegian arm of present-day Aker Yards has a strong gravitation point at the North Western coast of Norway, traditionally a region with a strong shipbuilding industry, and state remaining linkages to both maritime cluster actors (specialized offshore vessel operators, equipment suppliers and maritime consultancy firms) and to specialized research institutes (e.g. Marintek in Trondheim).

Strategic functions and the nature of core competencies

As discussed elsewhere (Herstad and Jonsdottir (red) 2006), we use the term “strategic functions’ to refer to those corporate activities that directly or indirectly are producing, reproducing and accumulating corporate core competencies. These are then distinguished from “operations”, similar to the concept of “complementary capabilities’ used by Teece (2001), which are corporate functions that enable core competencies to be turned into products with commercial value without significant prospects of contributing knowledge relevant to technological development. The concept is wider than “research and development”; it includes R&D-departments, headquarter-functions but may or may not include other functions such as production and marketing. Put simply; it includes both R&D as such but also other functions that may be important in providing the knowledge resource base on which R&D must build – and thus be integrated with.

Delineating strategic functions from operations require an understanding of basic specific characteristics of technologies and work process involved – in specific firms and in specific sectors. This is the classic argument by Pavitt (1984) of systematic knowledge base variations between industrial sectors (Asheim and Gertler 2005, Fagerberg 2005,

Tunzelmann and Acha 2005). Because knowledge bases vary, so do the necessary interaction and communication patterns that form the basis for learning processes and innovation; the elements involved in these and thus what constitutes strategic functions. Understanding the specificities of involved knowledge bases is also necessary in order to understand the prospects for, and challenges involved in, creating corporate learning networks that span different locations, and the need to link up knowledge providing actors externally. Identifying and analyzing such networks, in turn, is necessary in order to answer our research question concerning the impacts of a multinational presence on home-base knowledge accumulation and by implication home-base NIS

In the following we will apply a distinction between analytical knowledge and synthetic knowledge; distinctions that both relate to the process of generating knowledge, the process of using knowledge (innovating) and the process of communicating knowledge in networks. Analytical knowledge is disciplinary, science-based knowledge generated through formal research, easily communicated using well-established codes and easily sourced through external labor markets surrounding e.g. universities or other research institutes. Synthetic knowledge, on the other hand, is cross-disciplinary firm or sector specific knowledge. It is generated more through learning-by-doing and trial-and-error than formal research; and it is much more difficult to communicate and interact around as there are no generally accepted codes. It can to a much lesser extent than analytical knowledge be sourced directly from universities, or from labor markets; thus increasing the importance of in-house knowledge accumulation, and it is to a lesser extent generated through the formal process of 'doing R&D' (see Herstad and Jonsdottir 2006 for a more thorough discussion related to DOMUS, or Asheim and Gertler 2005)

According to Asheim and Gertler (2005), shipbuilding is a prime example of an industry relying on a synthetic knowledge base. Innovation in shipbuilding primarily takes the form of concrete problem-solving on behalf of customers (incremental innovations), according to customer requirements and within certain pre-defined budget constraints. It only takes the form of R&D-driven radical innovations, and is less research-driven than application and learning-by-doing oriented: "We do not conduct R&D for the sake of R&D itself, but innovative as an integrated part of running the shop". It involves a range of tasks and knowledge that span from simple hull construction to design and assembly of complex, technological systems necessitating interaction between a broad range of disciplines. It is knowledge intensive without being science intensive, and to a high degree tacit and experience-based.

Our Aker Yards respondent stresses that the knowledge intensive parts of developing and assembling a complex vessel are found at the conceptual design and final assembly stages11; that these must interact tightly to meet the challenge of designing and putting together systems that interact according to need. They explicitly state that 'you can isolate R&D from production, but the result is never good. Others have tried it, and made

[11] It is interesting to note that Aker Yards in addition to hull construction define so-called detailed engineering as a non-strategic function, outsourced to engineering companies in Russia or conducted at own yards in Rumania, whereas production in the sense of final assembly and outfitting is considered strategic (see Nilsen 2001 for an analysis of former Aker Maritime) on a level comparable to R&D.

a lot of strange things at a very high cost'. Hence, the downstream parts of production, and the upstream parts of R&D are characterized as indivisible, and innovation as rooted in 'the good and close dialogue between marketing, R&D and production'. The mid parts of the value chain, detail engineering and hull assembly, are on the other hand characterized as mere 'operations' without direct linkages to core competency development.

Similarly, Tandberg Data explicitly highlight how their knowledge base is comprised of a very specific and highly integrated blend of competencies in fields such as micro-mechanics, electronics and software: 'We are extremely cross-disciplinary, our main strength is our ability to think across disciplines. We therefore have to do most of our development work internally, based on accumulated in-house competencies. Our experiences have told us that we can only outsource things that can easily be done in isolation from everything else. Our OEM customers are very, very impressed with the breath of competencies of our engineers, they tend to think more in disciplinary boxes''. According to all three respondents, from a solely technological point of view this means that R&D and production must be considered an integrated entity: 'It is very difficult to design-for-production, and follow up and de-bugg new products, without very strong linkages between the two'. Initially having outsourced all production to China, in 2004 Tandberg re-established a pilot production line at its Oslo plant. Respondents still stress that they are concerned about the long-term effects of dissolving the linkages between large-scale production and product engineering necessitated by the lower production costs achieved in China. Again we find that the inter-relationship between R&D and production constitute strategic functions.

Paint producer Jotun describes its core competencies as divided between paint base development and antifouling polymer development, the latter portrayed as far more technologically demanding and strategically important than the former and a direct product of its historical emphasis on the maritime market. It is perhaps the case company that best illustrate the need to transform science-based disciplinary knowledge (chemistry) into firm specific, synthetic (Asheim and Gertler 2005) knowledge (paint technology): 'You don't learn this at University. Our main challenge is finding people with a degree in chemistry that is willing to get their hands dirty, learn this very specific trade. We have nowhere to go to find people; they have nowhere to go if they want to leave us[12]. If we employ somebody new in the R&D department it can take up to five years before that person starts generating a return'. However, respondents stress that R&D may very well be conducted isolated from production, which is described as a fairly generic and simple process, but also that 'strategic functions' clearly extend beyond R&D and into marketing and direct user-producer interaction.

A more difficult and less clear-cut case is Kverneland, operating in a market for farm implements that during the 1990s has been transformed dramatically with the introduction new ICT technologies such as GPS positioning, electronic control systems and robotics. The different unit core competencies and knowledge bases can be

[12] This is a dilemma that has received extensive attention in work on corporate governance; see e.g. Blair (1997)

described as firm specific and highly synthetic, being constituted by blend of metal, mechanical engineering and ICT competencies, and competencies on farming developed in close interaction with users and agricultural universities. This is the fundamental explanatory variable behind Kvernelands international growth through acquisitions, and simultaneously the prime reasons for the large investments in and partial failure of the corporate restructuring efforts starting in 2000 (Herstad 2000, Asheim and Herstad 2005). The Norwegian activities of Kverneland can be described as divided between HQ functions, a CoE function for the group as a whole in material treatment and technology; and plough production and development.

An even more complex picture is found in the case of Wilh Wilhelmsen Group. Our group HQ and owner respondents explicitly emphasize how the core competencies of their activities are distributed throughout the global organization, very specific to the product market in question, highly synthetic and experience-based: It must, according to one respondent, be developed and used as a result of "the handshake between raw practitioners and theoretical knowledge" where emphasis must be put more on the former than the latter and neither learning nor innovation can occur as a result of "putting bright-headed people together in a room and make them come up with new solutions to something". Core competencies are described as distributed within the global organization, where learning processes occur as continuous learning-by-doing in interaction with customers and with other group entities. Hence, delineating strategic functions from mere operations, and identifying the localization pattern of strategic functions, is very difficult.

CENTRIFUGAL FORCES

Drivers of corporate internationalization

According to Narula (2002), and following the line of reasoning applied in the sectorial systems of innovation approach, the need for proximity to different groups follows from different sectorial and technology characteristics, and thus results in different patterns of internationalization. In the Narula framework a simple distinction is made between mature firms and technologies, following well-defined development paths, and firms in emerging sectors where the rate of technological change is high such paths have not yet been consolidated. The basic argument is that immature technologies or a high rate of technological change imply a need for broad external linkages to monitor and supply possible complementary knowledge, whereas mature technologies and lower rates of technological change reduces the rationale for such linkages. We have above extended this line of reasoning by pointing to different properties of knowledge bases; and will below extend it further by also taking into account product market differences.

Existing research on Norwegian corporate internationalization (Friberg (red) 2006) clearly show that access to cheap inputs has been one of the least important centrifugal forces. The same bulk of research clearly shows how proximity to markets and customers is the single most important reason to internationalize. A reasonable hypothesis is that this applies more for markets where the transaction frequency – i.e. transactions with specific customers - is high than for markets where the frequency is low; and more for activities serving professional user markets than for activities serving consumer markets. When a need for tailoring to professional users and a high transaction frequency are combined, and dense user-producer interaction is necessitated, the need for physical proximity to customers will become particularly strong. This line of reasoning is also valid upstream; when dense interaction with universities or research institutes is enabled or necessitated by the nature of involved knowledge bases; this may create strong centrifugal (internationalization of R&D to specific places) or centripetal (inertia in home-base R&D) forces. When the nature of involved knowledge bases results in such interaction being less strategically important; the centrifugal (host) or centripetal (home) forces exercised by such actors are limited.

The centrifugal forces of markets are to a high degree reflected in the internationalization patterns of Jotun and Tandberg Data. Jotun explicitly state that the limited Norwegian domestic market for decorative products and the historically large Norwegian shipping fleet are the two main reasons behind its early and extensive internationalization. Whereas the first stage was fairly opportunistic and related to a specific case of expected national economic growth; the following foreign establishment, in Thailand, was triggered by contacts with Norwegian shipping and brokerage firms and co-financed by key Norwegian ship-owners. The mid-70s expansion in Dubai was further driven by the existing regional market for deliveries of paints to vessels in transit, and plans for large-

scale shipyard activities. The recent relocation of the Paints and Powder division headquarters, including regional R&D laboratories to Dubai is similarly a direct result of the geographical configuration of the customer base; the same applies for the Decorative and Coatings divisions which still is headquartered and has its main R&D facilities in Norway. Similarly; when a regional R&D labs for marine paints was set up in South Korea this was a direct result of the need to adapt marine paint and antifouling technology to the mass production techniques applied at these yards, and Jotuns 1980s and 1990s emphasis on establishing production facilities and numerous sales offices in China is a direct reflection of increasing shipbuilding activities there.

In general, Jotun respondents stress that "development and production must take place as close to the end user as possible, as demand varies significantly between countries and customer groups. Proximity to other groups than customers is of little or no importance to us, and localization factors other than customers consequently unimportant". This, of course, is the combined result of a strong necessitated emphasis on in-house rather than network learning upstream (the nature of the knowledge base), and importance of market adaptation downstream (the nature of the product market). Thus, whereas 'research' is conducted in Norway, and highly contingent not on the Norwegian innovation system but on in-house competencies of the central R&D lab, the geography of 'development' is tightly linked to the geography of the customer base. It follows from this that remaining 'development' in Norway, Marine Coatings and Decorative, is tightly linked to the customer bases represented by the Norwegian maritime cluster and the Scandinavian decorative paints markets respectively.

Tandberg Data internationalized through the establishment of sales and support facilities, with one exception being a production facility in the US that later was terminated. Thus, the early stages of corporate internationalization was driven by a need for physical presence in its product markets, and hence of fronting OEM customers directly13. Its later stages of internationalization included limited R&D aimed at disc-based back-up technologies in the UK and Poland, as well as certain R&D for tape-based technologies in the US. Importantly, the company has an explicit strategy of doing certain R&D projects primarily in the US (see below): In the US we can run several projects simultaneously, simply buy buying the right people in the labor market and getting rid of them once we have finished. In Norway, we have to rely on existing resources, and this is clearly blocking the speed of development'. Thus, a division of labor appear to be emerging between R&D building on core competencies accumulated in-house in Norway, and a more flexible US organization doing R&D that 'can easily be done in isolation from everything else', e.g. without strong linkages to the Norwegian knowledge base.

An earlier study of Kverneland (Herstad 2000) argued that an important driver of acquisition-based internationalization of production during the 1990s was the need to protect the company against a hostile take-over, by growing in markets characterized by a very strong functional (different implements) and geographical (different places)

[13] In addition it used the internal distribution channels of Siemens extensively during its years as a German subsidiary.

differentiation. Thus, corporate internationalization of both R&D and production followed as an outcome of a perceived need to grow and diversify beyond what could be achieved by exports from Norway, and took the form of acquisitions given the importance of immediate access to product market specific synthetic knowledge bases and complementary assets such as brand names. This is however only part of large picture including the establishment of dedicated sales facilities abroad, to supply critical marketing and after-market support service functions in markets that are very geographically differentiated. Hence, it can be argued that internationalization of production and R&D has been driven not only by market proximity, as in the cases of Jotun and Tandberg Data, but also by specialized in-house competencies of acquired firms. Again, the market motive is the prime driver; technology and knowledge enters the equation primarily in the form of in-house competencies.

Aker Yards is a special case in that a low transaction frequency and few, professional customers in a truly global industry imply that geographical proximity to customer only play a very minor role in driving internationalization14. It is also a special case in shipbuilding in general with a sole focus on complex vessel design, thus not operating only based on synthetic but also highly specialized knowledge bases. These two factors combined explain why the main location factors is stated as a combination of external actors able to supply complementary although specialized competencies and capabilities, including both a regional sub-supplier system and research institutes with specialized maritime knowledge, and very large place-specific investments in buildings, machinery and infrastructure such as dry docs. Our respondents both in Aker Yards and Rolls Royce Marine both point out that when it comes to complex vessel assembly, broader workforce competencies are of extreme importance. Hence, the existing core units of Aker Yards in Finland, Norway and Germany are all yards with a long history within the maritime sector of their respective countries. Low-country activities are limited to the two yards in Rumania primarily used for the purpose of building hulls and doing certain standard engineering work, but these are in turn a prerequisite for the viability of the high-cost country strategic activities of Aker Yards.

Other factors that are stated as very important is flexibility in own capacity, and thus the ability to utilize surplus capacity and obtain contracts even at markets peaks. The respondent at Aker Yards emphasizes how the group portfolio of smaller and larger yards not only means that they are able to supply a variety of product markets, but also that their overall capacity is very flexible and able to adapt to such peaks. Last but not least, although not stated by the respondent, a major competitive factor in the specialized vessel market is of course the ability to control the total capacity in a given segment, thus being able to reduce the level of competition and block new competitors from entering. Given the huge place-specific fixed costs involved in shipbuilding; the dependence on external environments for support and the synthetic knowledge bases on which all activities must build these are requirements that can only be met by extensive internationalization.

[14] This requires certain modifications. It is generally argued that a very demanding national and in some cases regional customer base has been a key component in the development of the Norwegian maritime cluster. This still applies for the linkage between offshore supply vessel companies (customers), and vessel development, but it does not apply for e.g. cruise vessel production and development at Aker Finnyards.

Our last case, the Wilh Wilhelmsen group with is portfolio of marine logistics and support services is a very special case in that industry actors by definition are international actors, in an industry which similarly by definition is global. Further, the different service activities within the group by their very nature require physical presence in order to be conducted; and conducting these represent the prime knowledge generating activity of the company. Hence, the knowledge base of the group is necessarily geographically distributed. Further, its self-defined role as driver in ship technology development require close interaction with key yards and their 'external environments', found mainly in Japan and Korea. This implies that the technical ship design competencies increasingly are contained in units outside Norway. Last but not least; it has an explicit principle of outsourcing to countries with strong competence environments in the actual fields – and names the interplay between a weakening maritime cluster in Norway and strengthening environments in countries such as India or Korea as important in this respect. Again, this centripetal force must be understood in the context not of access to cheap labor; but of access to environments holding specific, synthetic knowledge.

Linkages to innovation systems abroad

Firms thus engage in R&D at foreign locations for numerous reasons, some of which are firm-specific (i.e. R&D triggered by in-house competencies of acquired firms), and some of which are location-specific. Location-specific factors span a range from characteristics of local or national markets (Jotun) to the properties of territorial innovation systems more broadly defined, as in the cases of Kverneland or Wilh. Wilhelmsen. Tapping into location-specific technological assets require strong linkages that are expensive and time-consuming to develop (Narula 2002); and hence even when these are a key motive for entry it is not given that they follow from presence in the specific location (Narula and Zanfei 2005). The obvious challenges of becoming familiar with and integrating into a new location may in itself prohibit attempts at establishing such linkages (ibid) beyond those that follow from necessary transactions within the value chain.

Kvernelands strategy of acquisition-based internationalization is described as having '…the positive side-effect of including the R&D networks of the individual units'. In addition, the Norwegian Klepp plant has a long-standing relationship with steel manufacturing companies, in particular in Germany but also in Sweden, who supply steel based on a patented Kverneland recipe. These have however been established and continue to exist independently of subsidiary presence abroad. Below we will show how Kverneland has faced more a challenge of in-house network formation, than a challenge of external network formation.

Jotun stresses that a certain degree of direct interaction with professional end user is necessary in the professional user divisions, in particular marine as the production technologies involved in shipbuilding differ significantly between vessel-by-vessel building at specialized yards, and mass production at Korean and Chinese yards. Apart from this, Jotun also stresses that proximity to other groups than customers are of little of no importance. Necessary contacts with chemical companies, in particular in Germany,

have been established and continue to operate independently of subsidiary presence abroad. Hence, apart from user-producer interaction Jotun presence abroad has established few linkages to innovation system actors abroad.

Complex vessel design and actual assembly necessitate a broad range of complementary capabilities, both at the design stages and that the assembly stages. It also involves a significant amount of incremental problem solving throughout the assembly stages. Thus, Aker Yards rely on interacting with a broad range of external actors surrounding e.g. the Finnyards activities. Hence, through these activities Aker Yards interact significantly with Finnish innovation system actors, both on the public funding side and on the supplier side. Similarly, Wilh. Wilhelmsen respondents state that they have 'contacts with specialized yards in Japan and Korea that has more character of long-term development projects than traditional relationships between customer and producer', and emphasize that this contacts extend into the 'environments surrounding the yards'. Whereas a strong emphasis traditionally has been put on linking design and operational competencies at HQ with vessel development projects, the weakening of HQ in relation to activities abroad in all respects imply that a consequence of this is not the strengthening of HQ competencies on complex vessel design but rather that 'our own design competencies are increasingly found abroad'.

The perhaps most interesting case in this respect is Tandberg Data, where all respondents explicitly stresses the difficulties inherent in a) linking domestic and foreign R&D, and b) creating well-functioning linkages to external research environments at home or abroad. VP Technology stresses how 'achieving synergies with external communities have proven extremely difficult, and transfer of experiences and knowledge have been close to zero. It is not that we haven't tried, rather the contrary, but we can't seem to make it work. A key element in this picture is complexity of technology; respondents all emphasize how R&D personnel must accumulate a lot of firm specific knowledge before they can functions as insiders.

THE INTERMEDIATES

Introduction

The analysis above has illustrate how foreign presences may provide vital complementary capabilities for the home-base activities of DOMs, and thus strengthen these by enabling broader market penetration than what could have been achieved by exports alone. From the perspective of home-base R&D and the larger NIS, these are indirect effects, working through the financial results of the company and contingent on the willingness to reinvest resulting earnings as competence development and R&D in Norway. The key question of direct knowledge upgrading of NIS through DOMs however remains unresolved: Obviously, important learning processes occur in the

foreign subsidiaries; and these are surrounded by networks to external innovation system actors representing a certain degree of 'local buzz' (Bathelt et al 2004). But to what extent, or rather under what conditions, does knowledge developed abroad link up with home-base operations, serving as 'global pipelines' directly contributing to upgrading first the corporate home-base knowledge base, and then, secondly, filter into the larger NIS surrounding it? This we have framed as a question of corporate organizational principles, and thus inter-unit network formation. Narula and Zanfei (2005:334) explicitly point out: 'It is not sufficient for foreign affiliates to internalize spillovers if it cannot make these available to the rest of the MNE', home-base activities included. Following Forsgren (1997) they go on to argue that 'a dispersion of R&D activities across the globe requires extensive co-ordination (…) complex linkages, both within the firm and between external networks and internal networks, require complex coordination if they are to provide optimal benefits. Such co-ordination requires expertise, managerial and financial resources'.

Similar insights are found in Bathelt et al (2004), who argue that 'to successfully establish a global pipeline (…) requires the development of a shared institutional context which enables joint problem-solving, learning and knowledge creation. Knowledge flows through pipelines are not automatic, and participation is not free'. They require investments in 'communicative skills' (Forsgren 1997), in turn limiting the diversity of technologies and locations that individual DOM pipelines effectively can cover (Bathelt et al 2004:43, Forsgren 1997:74) within a given budget constraint (Herstad 2005). The contrast between Aker Yards and Kverneland will illustrate this well.

Corporate organizational principles

We have elsewhere introduced the two complementary concepts of portfolios or industrial systems as corporate international organizational principles, and of control through formalization, centralization or socialization as mode of co-ordination (Persaud 2005, Herstad 2005, Geppert, Mattens and Williams 2003, Herstad and Jonsdottir (red) 2006). The purpose of developing and applying these distinctions is to grasp key characteristics of the organizational and control system setting within which actual communication patters and inter-unit learning processes must occur. They are established concepts within certain strands of research on multinational organizations, mainly through the work of Bartlett and Ghoshal (1998), related Nordic contributions (Granstrand and Sjölander 1994, Forsgren 1997, Forsgren et al 1997) and through certain strands of theory dealing with the linkages between corporate control and structure (Porter (red) 1992, Fukao 1995, Morgan 2001). They have however not been incorporated into work attempting to draw implications of the internationalization of R&D through the activities or multinational corporations.

The above has demonstrated how Kverneland expanded rapidly throughout the 1990s, and consequently found itself controlling a large and very diverse portfolio of activities serving highly differentiated product markets. An earlier study (Herstad 2000) identified a strong emphasis on and huge investments in corporate integration in the wake of this expansion, establishing a fairly centralized corporate structure. This generated a huge

information load on HQ and severe problems of co-ordination between operative units, and is now by respondents characterized as 'technologically a success, but market-wise and administratively a complete disaster15'. The idea was to let existing production units and distribution networks serve this function only, and concentrate all product development in a few key units, including the Norwegian Klepp plant. Following the Umoe Group involvement in Kverneland, the group was reorganized as numerous centers of excellence for product development, linked tightly to production units, and supported by two additional centers explicitly set up for the purpose of serving inter-unit R&D and knowledge diffusion functions. In this structure, the Norwegian Klepp plant is Coe for material technology.

The overall objective is to increase inter-unit technological synergies without the administrative constraints of centralization by allowing for decentralized interaction patterns to evolve organically. Hence, Kverneland is at present investing heavily in building what is described as a 'unique inter-company organizational structure', and thus industrial system. Respondents stress that this must involve systematic circulation of personnel on a long-term basis (i.e. as this involves specialized, synthetic knowledge), and exemplifies by pointing to German researchers now present at the Klepp plant.

As a result of this emphasis and the related investments, a distinct inter-unit R&D network is in the process of consolidating. Patent analysis (Ebersberger 2006) clearly reveals a strong pattern of inter-unit co-patenting; with the defined centres of excellence in Norway and the Netherlands as apparent key actors (ibid; Herstad and Jonsdottir 8red) 2006)

Aker Yards illustrate how three different complementarities can co-exist within a international industrial system. First; the establishment of the group itself was motivated by recognition that size and flexibility in production capacity is pre-requisite for competitiveness in the shipbuilding industry. With the merger of numerous smaller specialized yards in Norway, larger specialized yards in Finland, mass-producing yards in Germany and low-end yards in Rumania Aker have establish an internal flexibility that enable the group to solve a wide range of problems, cope with cyclical fluctuations and thus open for new projects even at market peaks16. Further, by locating knowledge intensive activities at specialized units in high-cost countries, and either outsourcing all non-knowledge intensive activities to low-cost countries or conduct them internally at the Rumanian yards, the group has established an internal international division of labor that support rather than substitute activities in high-cost countries. Last but not least a strong emphasis is put on designing, establishing and maintaining a corporate 'research, development and innovation network' to harness technological synergies between units. Hence, according to our respondent 'we are putting an enormous amount of resources and efforts into creating linkages between the different units; we have a very strong belief that

[15] Please not that this illustrate possible tensions between different objectives sought met by the organisational principles of the MNE.

[16] The specialised vessel division recently signed its largest contract ever, with Maersk of Denmark. Rapid, reliable delivery was stated as the main reason why lower-priced offers from Asian yards were rejected in Akers favour.

strong synergies may be harnesses. For instance, we want to link Norwegian specialized vessel design with Finnish competencies on design for arctic conditions'.

Supporting this is a clear case of co-ordination by socialization (Bartlett and Ghoshal 1998); decentralization of decision-making power, frequent dialogue and face-to-face interaction between a variety of personnel and 'hands-on management'17 contribute to establishing a framework within which the information strain of centralization and the strategic and unit segmentation of formalization is avoided, simultaneously. It supports the establishment of a 'shared institutional context' (Bathelt et al 2004) by allowing '…free change of personnel between units' (Granstrand and Sjölander 1994), thus fostering inter-unit learning (ibid). The high costs involved are justified only by expected long-term impact on capacity to innovate, and is enabled in this form – broad, direct personal linkages – by the fact that the number of units and the technological variety to be integrated is fairly limited (Herstad 2005, Forsgren 1997).

Jotun operate with a long-standing principle of doing development work 'as close to the end user as possible', and basic R&D at the Sandefjord plant in Norway. In the present corporate structure its regional R&D labs are responsible for market adaptation of basic technology developed in Sandefjord, whereas the latter is responsible for quality control of all R&D abroad, HSE-issues and co-ordination of R&D. Thus, the corporate organizational set-up and the linkages between HQ and regional labs are explicitly stated as designed for the purpose of bridging Norwegian research, regional development and regional markets, and 'strong learning effects at the Sandefjord lab' are stated as an actual outcome of this. The respondents also emphasize that while HQ define playing rules for the regional labs, these are not financial by nature and units are allowed to cross-subsidize each other for long periods of time given that the market or technological rationale is present. This eliminates individual unit opportunism (Herstad 2005), hence strengthening co-operation. The company has a strong emphasis on circulation of personnel between units, but state that this is difficult to achieve in practice at a sufficient scale because people do not want to relocate abroad or visit Norway for a sufficient period of time.

As the very nature of its activities presupposes distributed competencies and inter-unit interaction the options faced by Wilh. Wilhelmsen concerning corporate organizational principles are fairly limited. Our respondents all however stress that whereas the traditional method of co-ordination in shipping has been centralized control-and-command, the group has systematically built on the principles of local empowerment and co-ordination through 'socialization': "We have consciously built our competitive advantage on knowledge development throughout the organization, and have been careful about not applying the command-and-control principle so common in shipping. Rather, we have focused on co-operation and enabling individual and collective creativity". This is stated as challenging when faced with the cultural diversity of the group: "However, we also need to reduce uncertainty, make sure that everybody acts according to expectations towards customers, and in according to intentions towards us at HQ". The

[17] I.e. the principles that managers on ALL levels must have first-hand knowledge of the work or development processes they control.

group has needed to establish common interpretative schemes (Bathelt et al 2004:43) and logics of collective action: "We stress developing an organizational culture independent of places, based on what we think of as the Nordic model. This particularly applies to the role of hierarchy and operative leaders". Critical framework conditions in this respect are leadership training at the group academy, very extensive mobility of personnel and frequent travel between HQ and operational units. As Jotun, Wilh Wilhelmsen respondents stresses that the latter poses certain distinct challenges as to making foreigners come to Norway, and that Norwegian taxation legislation actively work against not having Norwegians stationed abroad, but maintaining the linkages between such personnel and HQ18. As a result, 'we increasingly use Swedish personnel for this purpose'.

The corporate structure of Tandberg Data was initially characterized by broad decentralization of responsibility to different marketing and sales affiliates abroad, and production at the US plant. However, the present-day structure is one of re-centralization. Extensive decentralization created problems because sales and support – towards professional customers – became far to decoupled from specialized engineering competencies of Tandberg in Norway. Re-centralization has in turn implied that very extensive traveling between HQ and subsidiaries has been necessitated in order to achieve the key connection between technical understanding and customer needs. This primarily takes the form of Norwegians going abroad, and inevitably result in Norwegian R&D becoming tighter linked to customer needs and preferences than would have been possible without sales offices functioning as listening posts. However, the exchange of personnel in the opposite direction is stated as very limited; thus also limiting the strength of this pipeline.

Very specialized and synthetic core competencies combined with limited mutual exchange of personnel further result in technological synergies between HQ and units abroad being very difficult to harness. Our VP technology respondent e.g. point out that whereas R&D in the US has a long-standing tradition, the unit is still 'fairly isolated from R&D in Norway. The distance is to long. People have to be present here in order to learn the products, learn the technology, or we have to send people over there to be present for quite some time'. The latter would imply investments in learning interfaces beyond what TD now has the financial leeway to conduct19. It is reasonable to expect that a similarly segmented relationship will develop between HQ and R&D units in Poland and the UK; described as' fairly new, and interfaces are in the development phase and we do not know yet how they will consolidate'.

[18] Norwegians living abroad can only be present in Norway for 60 days per year, including travel time, before they are defined as having moved home and thus made subject to Norwegian income taxation. This implies that they can only participate in a limited number of HQ meetings.

[19] On this issue there is a certain disagreement between CEO and VP Technology. Whereas the former state that distance can easily be overcome by using modern ICT, the latter insist on long-term face-to-face interaction being a prerequisite for knowledge diffusion.

Corporate internationalization and strategic control

Two critical interfaces have been referred to above: The external interface between subsidiaries and their surrounding environment, and the internal network interface between subsidiaries as such and the home-base activities of DOMs. We have argued that both are costly, time-consuming and risky to build, as they require a significant amount of trial-and-error and tie up human resources for long periods of time (Bathelt et al 2004:43, Herstad 2005:75-85, 188-198). The empirical analysis more than anything illustrate these analytical points. Meeting challenges by trial, error, selection and temporary consolidation is in turn a process of which we will argue that the outcome is highly contingent on strategic control – the committedness and competencies of owners and managers (Narula and Zanfei 2005) respectively, the end result they have defined as achievable through internationalization and the corporate structure that follows from this strategy (Morgan 2001, Porter (red) 1992, Chandler 1962).

Extending this into a system argument we argue that it is not only the national innovation system that forms the basis for corporate internationalization; it is also the national corporate governance system. The national innovation system provides the technological basis for firm internationalization; the corporate governance system provides the basis for the structure and strategy of internationalization.

The case of Tandberg Data is clearly illustrative of how this aspect can translate into several implications for structure and strategy. From the perspective of DOMUS it is most interesting to observe how possible technological dynamism in the interplay between foreign and Norwegian R&D is not explored because of budget constraints imposed on investments in organizational interfaces. This extends into marketing and customer fronting functions of all subsidiaries not being sufficiently utilized as it illustrates the seemingly paradoxical situation of a small, high-end developer and producer, very dependent on both aggressive international marketing and its ability to be at the technological forefront, not being able to invest sufficiently in neither marketing nor product development 'beyond finalizing the projects we are working on at present'. It is explicitly stated by the respondents that the main, underlying problem is budget constraints imposed by '…the short money' that constitute its present ownership structure: 'It is too much focus on indicators, on what will happen in a few week, our owners just don't understand what we are trying to do and we cant make them understand it. We are suffering from a very stressing day-to-day existence, and cannot think ahead'.

This interpretation becomes increasingly plausible when viewed against the background of evidence from the other case corporations. Jotun stresses how family ownership has enabled 'commitment to chosen strategies over long periods of time, commitment of resources for long periods of time'. This applies for R&D projects, but importantly also for internationalization strategies and subsidiary establishments abroad: "We are dong things without any consideration as to effect on the bottom line. There are no specific requirements as to pay-back time on investments. Units are allowed to cross-subsidize each other according to need, and our ability to commit has proven very valuable when entering new markets and developing new activities abroad". A similar picture is portrayed by management respondents in Wilh. Wilhelmsen: 'The only thing that matters

is the long-term survival of the company. I doubt very much that we could have put so much effort on organizational development, and build the company group we have built, if we did not have a committed owner'.

Earlier interviews with Kverneland Klepp management (Herstad 2000, 2003) portrayed a company caught between failing markets, escalating costs related to corporate restructuring and integration, and a strong perceived threat of a hostile take-over. They also revealed a strong resulting focus on protecting the market capitalization of the company; necessarily simultaneous with attempts at restructuring and consolidating the new corporate group and create the above-mentioned R&D network. The entry of the Umoe Group as main owner effectively blocked the threat of a take-over, and the group has contributed significantly to Kverneland corporate restructuring – including the present-day emphasis on consolidating and strengthening the R&D network of the group. Similarly, VP R&D and technology in Aker Yards describes how 'Aker was owned by a bunch of institutional investors who had absolutely no clue about what we where doing and that wasn't particularly fun. We had huge cash reserves, but our management was paralyzed and had no idea about what to do with it strategically". This changed dramatically with the entry of RGI, the transformation of former Kvaerner and Aker groups respectively and the consequent establishment of the third largest shipbuilding group in the world: 'We are now a dynamic and risk-willing organization'.

As indicated, the purpose with these firm-level examples is to highlight a system level argument: Availability of financial resources to support internationalization, with an investment horizon compatible with the challenges of international organizational development, linked to owner and management strategic competencies on internationalization provide one of the key determinants for a) the extent of corporate internationalization from any given national economy; and b) the structure and success of corporate internationalization. A strong national performance on outward FDI thus appears to require a strong national industrial capital (Perez 2002) base (Fukao 1995, Ruigrok and van Tulder 1997, Doremus et al 1998, Morgan et al 2001, Collin 1998). This, in turn, is a known weakness of the Norwegian economy (NOU 2004, Roland et al 2001), when compared to e.g. Sweden or Denmark.

CENTRIPETAL FORCES

Domestic embeddedness

The case companies show varying degrees of home-base orientation in the strategic activities; but common for all companies is that those strategic functions that remain at home do so primarily not because of embeddedness in external relationships domestically, Aker Yards being a possible exception to this rule, but because reliance on synthetic, specialized and 'sticky' knowledge embedded in those same operations. We thus argue that the location of in-house competencies may explain external domestic linkages, not necessarily vice versa as often implicitly assumed. The role of the company as a knowledge developing entity in its own right, internally producing its own 'inertia' in R&D location by reproducing its dependence on a knowledge base held collectively by its domestic employees, should not be underestimated. This inertia becomes stronger with increasing degrees of specialization of synthetic knowledge bases, creating a stronger and stronger reliance on in-house competencies; making it increasingly difficult to find relevant partners externally and making it increasingly difficult to establish real, working linkages to such partners once identified. This 'dis-embedding' from external linkages has been argued to be an inherent characteristic of maturing, knowledge based companies in sectors necessarily operating based on specific, synthetic knowledge bases (see e.g. Asheim and Herstad 2005, Herstad 2003).

This line of reasoning can be extended further. When foreign R&D exist on a scale of some significance, as in the cases of Kverneland and Aker Yards, this R&D is primarily triggered by acquisitions motivated by similar specialized in-house competencies of acquired firms – and by their external networks only to the extent that these are part-and-parcel of the former competencies. As acquisitions are the main modes of entry into foreign markets for Nordic DOMs in general (Friberg (red) 2006), this can be expected to have validity beyond our specific selection of firms. Only in the case of Jotun do we find that R&D is built bottom-up in local contexts; but in this case more as adaptive 'development' than the fundamental 'research' that remain based on the specialized, synthetic competencies of the Norwegian laboratory – and a consequence of acquisition candidates holding relevant specialized knowledge not existing in targeted markets.

A very good illustrative example is Wilh. Wilhelmsen. All respondents highlight the importance of competencies embedded in-house at corporate and division HQs in Norway as the main source of localizational 'inertia' – to such an extent that *relocating* is stated as not an option, only *rebuilding* what would then inevitably be '…something different'. These competencies are reproduced through the coordinating role of group and division HQs, and thus directly feed on global pipelines. There are linkages to external innovation system actors in Norway which are stated as strengthening this inertia, namely

Norwegian shipping specialist lawyers and shipping specialist banks20, but these are also stated as decreasing in importance with the erosion of the national maritime cluster. Similarly, organizational embeddedness of core competencies block Tandberg Data cannot relocate R&D because of the. No external domestic linkages are stated as important; but the broader context surrounding Norwegian R&D is important in that it enable stability and commitment in its engineering workforce.

As WW and Jotun, Aker Yards represent a large proportion of what remains of the national maritime cluster. It remains embedded in linkages to innovation system actors such as Norwegian Technical University and Marintek, and various ship design companies, but stresses that it sees building internal competencies in areas traditionally covered by external partnering is emphasized to compensate for weakening cluster characteristics and to ease the establishment of in-house R&D networks. Hence, Aker Yards strategy involves dis-embedding itself from external co-operation in Norway, although to the benefit of domestic in-house competence development in Norway.

Given the organizational competencies that necessarily will be embedded in the domestic operations of internationalizing companies, relocating – in practice closing down and re-building elsewhere - home-base strategic functions will only rarely be sensible from a technological point of view. Internationalization and consequent unit specialization following from group restructuring will necessarily result in competencies being accumulated at HQ, and most likely with group consolidation result in the group as a whole becoming increasingly dependent on the coordinating and strategically guiding role of HQ, thus further deepening this role. The more complex industrial systems that are establish, the more distinct this dynamic will be. The domestic activities of Wilh. Wilhelmsen provides a very clear example of this dynamic.

Attempting to complement these activities by establishing strategic activities or mere operations abroad – be it marketing, production or R&D – may however be highly necessary. And further, given the important role of HQ and home-base R&D in coordinating activities on a world-wide scale, it will in the long run only rarely be sensible to disconnect home-base activities from foreign activities and/or automatically downsize home-base activities when foreign activities grow (not that this implies that companies wont do it anyway, as the case of former Kvaerner illustrate with its complete relocation to London, only to move home again, or fail in creating sufficient home-host linkages). It does however imply that domestic activities changes in nature; i.e. towards a stronger emphasis on basic research, certain development activities or administrative functions. Thus, it follows from this that domestic and foreign operations in general should be viewed as relationships characterized by co-evolution rather than relocation and substitution

[20] The two largest shipping banks in the world, measured by market share, are Norwegian bank DNB NOR and former Norwegian bank Kredittkassen, now a part of Sweden-based NORDEA.

GLOBAL PIPELINES?

The analysis has argued that there are knowledge flows occuring between different units of DOMs, and that there are assymmetries in the direction of these flows that favour corporate domestic operations. Pipelines are existing. The question then becomes what these pipelines are supplying to domestic corporation and the larger NIS surrounding it, how and what limiations there are. There are clear challengels involved; there is a lot of information floating about in corporate networks to the extent that these are established; and well-fuctioning pipeline are balancing on knifes edge between excessive integration and information overolad on the one side (i.e. initially the case in both Kverneland and Jotun), and arms-length relations with few exchanges on the other (i.e. as in the case of Tandberg Data). On both sides of the knife edge the outcome can easily the the same; lack of real knowlege synergies within the network. Strong decentralisation enable unit adaption to local markets and NIS actors, whereas strong co-ordination and integration create precondtions for network formation but limiti the scope for the latter adaption and embeddedness.

From the NIS perspective additional factors need to be considered. DOMs only serve as global pipelines for the respective larger domestic systems to the exent that linkages to these systems are strong enought for externalities to occur; and to the extent that the external systems themselves have sufficient abosrptive capacity within the relevant syntetic or analytical knowledge fields in question. Quantitative data showing that DOMs utilise the domestic innovation system is neither sufficient to make the statement that this in turn creates externalities into this system, traceable back to the foreign operations of DOMs.

The question of externalities from the DOM and implicitly its foreign operations through linkages to national innovation system actors cannot be resolved without in-depth investigation the direction of knowledge flows and thus possible assymmetries (Lam 2002) in knowledge transfer processes within these domestic networks – and thus the nature of in-depth vs. arms length research collaboration. In other words; we do not know the extent to which the utilisation of the domestic science system occur as outsourcing of things that can easily be specified and conducted in isolation from everything else, or deeper relationships or a more reflexive (Storper 1997) and co-evolutionary character. Our empirical evidence on this is sufficient only for raising the question, not providing answers.

In broader perspective externalities will of course inveitably occur through labour market mobility; but the extent to which they actually do are contingent on the external moblity of personell between different DOMs, and research instituties. In the Norwegian cases this mobility appear to be very limited. Limiting this mobility is of course the degree of firm specificy in involved knowlege bases (defining the value of researcher knowledge outside specific firms (Blair 1997)), combined with a lacking existence of employers operating in related sectors. In the words of Jotun; ’...we have nowhere to go to employ

researchers, and they have nowhere to go if they want to leave us'. This, in turn leads us to conclude that important in securing that NIS externalities occur are the existence of a broader cluster of related activities domestically; supplier firms, competitors and highly specialised research instituties supplying relevant employment opportunities for researchers and other strategic personell initially employeed in DOMs - thus constituting a larger network able to diffuse knowledge generated through its global pipeline into NIS. Is these prerequisites are not met; the knowledge generated by the pipeline will remain inside the domestic operations of the DOM, and no or very limited externalities into NIS will occur.

We thus conclude that domestic multinationals primarily serve as pipelines for their domestic NIS to the extent that the latter represent a certain critical mass within relevant technological fields; a critical mass consisting of competing firms, tight user-producer relationships and specialised research instituties linked by well-functioning external labour markets for specialsts. A particular illustrative general example is the Wilh. Wilhelmsen Group Norwegian group and divion HQs; representing global gravitation points for advanced and specialised (e.g. car carriers) maritime logistics whos remaining linkages to a weakening Norwegian maritime cluster provide fewer and fewer channels for spill-overs into a surrounding environment with weakening absorptive capacity.

Forsgren (1997) identified the so-called 'advantage paradox' of the multinational corporation; the trade-off between technological variety (presence in a variety of contexts) and technological synergy (integration between different context). Following from this, we argue that there from a NIS perspective exist an additional advantage paradox between a) strong domestic NIS linkages and thus channels for spill-overs, b) strong network linkages within the MNE, feeding knowledge back to DOM domestic organisation, and c) strong linkages to innovation system actors in the host context. For instance, the ability of DOMs to create internal but inter-unit corporate labour markets dramatically increases knowledge flows within the group; but possibly at the expense of DOM domestic spill-overs through the labour market. Similarly, if a given R&D budget predominantly is used for in-house R&D and acquisition of technology domestically; this increases the likelihood of domestic spill-overs but decreases the likelihood of the DOM serving a pipeline role – of there being anything to spill over. If it for some time predominantly is used on organisational development and multi-unit projects within the group, or on R&D in subsidiaries, it dramatically increases the foreign linkage and pipeline role of the DOM; but most likely at the expense of domestic linkages.

Iceland: Ossur and Actavis

By Ásdís Jónsdóttir, RANNIS

Introduction

The purpose of DOMUS is to "*study the role of large domestic multinationals in the national innovation system (NIS)"*. This Icelandic sub-study looks at innovation activity in two Icelandic domestic multinationals with the aim of exploring the links these companies create between the different innovation systems they are attached to, through their operations at home and abroad. Of special interest is the question of whether internationalisation of Icelandic companies has the effect of replacing or complementing their innovation activities at home. To do that, it is important to identify factors that influence localisation decisions of strategic functions, such as R&D.

Internationalisation and innovation

Once Icelandic companies decide to step outside the limits of Icelandic coastline and thus expand their markets and possibilities, the question becomes: what explains their different internationalisation patterns? New markets do not simply offer possibilities of selling more products developed and produced at home or getting them developed and produced at lower costs, they have the potential of being an arena of learning, and therefore enhancing the possibilities of innovation. To what extent these new possibilities are exploited and whether they have the effect of strengthening or weakening home functions, especially the knowledge-intensive activities at home, is among other things linked to the organisational structure of the company. The organisational structure is, in turn, highly linked to the technological and sectorial nature of the firm. Thus, technological and sectorial differences can account for some of the differences of patterns of internationalisation and organisational structural adaptation, including interaction and communication patters, to learning from geographically diffused sources (Narula, 2002).

Various concepts have been used in order to analyse differences in the nature of technology and core knowledge, to understand dissimilarities in internationalisation patterns. First, a firm's technology is either mature or immature. Mature technologies:

> Evolve slowly and demonstrate minor but consistent innovations over time […] The technology is to a great extent codifiable, widely disseminated, and the property rights well-defined. […] Competition shifts towards

> price, economies of scale and downstream activities in order to add value, as the original product is priced as a commodity (Narula, 2002: 796-797).

On the other hand, immature technologies, such as those in emerging sectors, change rapidly and are difficult to codify.

Second, different technologies require fundamentally different knowledge-bases. Immature technologies are based on highly tacit knowledge. Here we use the distinction between analytical knowledge on the one hand and synthetic knowledge on the other:

> Analytical knowledge is disciplinary, science-based knowledge generated through formal research, easily communicated using well-established codes and easily sourced through external labour markets surrounding, e.g. universities or other research institutes. Synthetic knowledge, on the other hand, is cross-disciplinary firm or sector specific knowledge. It is generated more through learning-by-doing and trial-and-error than formal research; and it is much more difficult to communicate and interact around as there are no generally accepted codes. It is to a lesser extent […] be sourced directly from universities (Herstad, in print).

Most companies use both types of knowledge, but what is of fundamental importance here, is which type dominates in the firm's "strategic functions", i.e. those corporate activities that produce and reproduce competencies that contribute to its technological development and advancement. In short, the competencies necessary for innovation.

Organisational patterns

Different mechanisms of coordination and control in MNEs imply different processes in the use of knowledge and organisational learning. Technological and sectorial characteristics are one of the factors influencing the organisational setup, communication and interaction. Here we distinguish between two modes of MNE organisations: Industrial systems and portfolios. In portfolios subsidiaries are functionally independent units, governed and coordinated through formalisation. The term "formalisation" refers to the use of management systems based on formal policies and standards, such as performance indicator measures (Bartlett and Ghoshal, 1998). In industrial systems, however, emphasis is put on harnessing inter-organisational links between subsidiaries and headquarters. There is a closer cooperation between different units, more knowledge flow and thus, more potential for inter-organisational learning. Control is attained by the use of centralisation or socialisation rather than with measurable targets (Herstad and Jónsdóttir, in print).

It may be hypothesised that formalisation methods are more easily applicable where core competencies are codifiable and rely more on analytical knowledge than synthetic. Furthermore, cultural differences in structures of control may exist. Bartlett and Ghoshal

(1998) point out that whereas formalisation is a preferred coordinative mechanism in American companies, European firms tend to put more emphasis on socialisation and the Japanese on centralisation. It is also to be emphasised that MNEs often are complex structures and different methods of control may be used all at the same time. Dominant modes of control may also be subject to various changes over time.

The case study on domestic multinationals in Iceland

In order to understand the role of domestic multinationals in the home NIS, case studies were performed in several Nordic companies. In this report, I describe the Icelandic case study companies, Ossur and Actavis in order to answer the question as to what extent these companies serve as global pipelines for the Icelandic NIS.

This is essentially an explorative study and, thus, in-depth qualitative analysis is used. The qualitative approach' explorative nature is especially suitable for "how" and "why" questions and offers the possibility of developing and clarifying concepts. Furthermore, it enables a focus on interactive processes and permits a study of the contextual conditions of phenomena and its boundaries. During the course of the study it became clear, for instance, that the qualitative approach served as a good way of exploring the processes and the meanings of "innovation" for these innovative companies, thus elucidating traditional and practical uses of the concept. Furthermore, it is important to note that the purpose of this study is not make statistical generalisations about Icelandic multinationals and their links to different national innovation systems, but to use them as sources to develop concepts and bring up potentially important issues on the question of the role of DOMs in the NIS.

Data about the case companies was gathered from multiple sources. In each company two managers were interviewed. In two cases, managers were interviewed twice. The interviews lasted one to two hours and were digitally recoded. Furthermore, written material, such as year-reports, newspaper articles, interviews and web pages, was extensively used.

The case companies

Ossur is currently the second largest orthopeadics company in the world and specialises in two sub-fields of orthopeadics, prosthetics on the one hand and orthotics on the other. Prosthetics deal with the production and fitting of artificial body parts, serving people who have through birth defects, accidents or illness experienced amputation. As a general rule, prosthetics are prescribed by specialist healthcare providers, although user participation in the decision process is increasing. The R&D of prosthetics is based in Iceland.

Orthotics are bracing and support products such as ankle and foot supports, wrist braces, back supports, collars as well as disposable medical products like scissors, clamps, gauze

and bandages. These products are either prescribed by specialists or sold directly to users. The R&D of orthotics is based in California.

Ossur has been growing fast and has, in fact, been listed as one of Europe's fastest growing companies. The number of employees ten folded in six years and increased from being 120 in 1999 to around 1200 in 2006. In 2006, around 260 (22%) employees were situated in Iceland. Eighty employees were in R&D, thereof 45 (56%) in Iceland. One fourth of the employees in manufacturing were situated in Iceland.

The demand for orthopaedic products is largely dependent on two factors. First, the local healthcare regulatory environment. Local systems of reimbursement can be widely variant and complex. Therefore, the procurement process is usually quite intricate. Also, because of the dependency on public regulations, the orthopaedic market's sensitivity to economic fluctuations is limited. Second, demographics, such as the age composition of the society have effects on the demand. Ageing in Western societies, as well as increase in diseases such as diabetes, greatly influences the orthopaedic market.

North-America provides the largest market for orthopaedic products in the world and in 2005 it accounted for 59% of the company's total sales. The European market is Ossur's second largest, with one third of the sales in 2005, the Nordic market representing around 11% thereof. Ossur's market position in the Nordic-Baltic region is strong and mature, providing less opportunities for growth than other regions. In 2005, Ossur strengthened its position in the Asian and Pacific region by acquiring a prosthetics distributor in Australia. The share of this market in total sales is still minor, accounting for only 7% in 2005. Ossur also recently opened a small R&D unit in Hong Kong with two employees.

Ossur has been listed on the Iceland Stock Exchange since 1999. Its largest shareholder is the Danish William Demant Invest A/S with a 37% share at the end of 2005. In January 2006 Niels Jacobsen, chairman William Demant, declared that the company did not intend a takeover in Ossur (Morgunbladid, 2006). About half of the shares are in foreign ownership and about half is owned by Icelandic investors. The largest Icelandic investor is Eyrir Invest with about 15% share at the end of 2005.

The generic pharmaceutical *Actavis Group* is also one of Iceland's fastest growing companies. In 1999 it had less than 150 employees and all of them were situated in Iceland. In 2006 the number of employees had risen to ten thousand in 32 countries. Around 500 (5%) were placed in Iceland. Actavis is currently one of three to five largest companies in the international generic pharmaceutical industry.

The Group has R&D activities in Iceland, USA, Denmark, India, Malta, Turkey and UK. Historically, the R&D has been centred in Iceland, but has recently been internationalising with new subsidiaries in the USA. The core of the headquarters is also in Iceland, although some of its managers are situated elsewhere.

The Group produces 600 medicines in different forms from capsules to lotions for both professional and consumer market. The products cover all therapeutic areas, but the most

important are antibacterial and cardiovascular drugs. Three fourths of the products are marketed under the Actavis' brand name and about 25% are sold through third party. In 2004 the company's name was changed from Pharmaco to Actavis in order to strengthen the corporate brand. This marked the Group's increasing focus on own-label sales. Third party sales have accordingly been decreasing. This change has demanded the development of a more extensive value-chain than before.

The pharmaceutical market is a very competitive one and it has been consolidating fast in the last years. However, most of the pharmaceutical companies either specialise in the European market or the American one. Very few operate in both (Birgisdóttir, 2006). Until recently, Actavis' main market was Eastern Europe and the Nordic countries. However, in 2005, after two acquisitions in the US, the North-American market became the Group's largest. Today, 42% of the company's revenues come from USA, 27% from Western-Europe and 23% from Central and Eastern Europe. The recent growth in North-America is especially important for the further development of Actavis since the US is by far the largest market for pharmaceuticals in the world. Furthermore, by being on both sides of the Atlantic Ocean it is possible to achieve synergistic effects in R&D. In addition, the company's co-operation with pharmaceutical producers in India further enables them to remain competitive on the US market with low-cost production (Birgisdóttir, 2006). Actavis is a leader in the domestic market which, however, only accounts for about 1% of the total revenues.

Actavis is listed in the Icelandic Stock Exchange. Amber International owns around 40%, Landsbanki 16% and Straumur-Burdarás Investment Bank 9%. Others own less than 2% each.

Pharmaceuticals and therapeutic products were first exported from Iceland in 1990. In 1995, the value of these exports was less than 20% of the value of imported pharmaceuticals. In 2006, the value of exports has outgrown the value of imports in the field (Birgisdóttir, 2006). In 2005, the export value of pharmaceuticals in Iceland was about 6 billion ISK, and almost 9 billion ISK in 2004 (Útflutningsrád Íslands, 2006). Both of the case companies are major actors in this process.

Corporate histories and internationalisation patterns

The Icelandic economy has traditionally built on fishing and agriculture. Neither Actavis nor Ossur grew out of traditional industrial clusters. Both are examples of entrepreneurial companies that were able internationalise due to the modernisation of the Icelandic economy in the 1990's. The main factors in the economic changes were transformations in the fisheries, fully realised in 1990 and allowing capital to flow out of the fishing industry; decreasing regulation of flow of funds; the entrance into the European Economic Area in 1992; and the privatisation of the Icelandic banks that started in 1999. Furthermore, the considerable Icelandic pension funds, provided an important backstop for the expansion of Icelandic businesses.

Of these factors, the newly privatised Icelandic banks were, in the beginning of the Internationalisation, especially important for Ossur and Actavis. The banks' knowledge of the Icelandic economy and the fact that they shared the vision of the companies and placed trust in them was an important prerequisite for the case study companies' Internationalisation.

In 1971 Ossur Kristinsson, a twenty-eight year old prosthetic, opened an workshop providing orthotics and prosthetics, together with several organisations of the disabled in Iceland. The workshop bore his first name, Ossur. During the seventies and most of the eighties, the business remained small, restrained by the tiny market in Iceland and little access to venture capital. R&D costs were a heavy load and mostly financed by loans from the Industrial Development Fund (Idnthróunarsjódur) (Morgunbladid, 1990).

Fifteen years after its establishment, in 1986, Ossur was granted its first patent for a silicone liner. The year 1989 marked a beginning of a new period of rapid growth for the company. In 1990 it had twenty employees and 25% of the turnover came from export. The share of exports in the total sales increased dramatically in the beginning of the nineties. The turnover grew from being five million Icelandic ISK in 1989, to 52 million ISK in 1991, and further to reach 420 million ISK in 1995.

In the mid-nineties, the company opened three sales-offices abroad; in Luxembourg, the UK and on the east-cost of the United States, with the aim of "*getting closer to the market to get more feedback and to be able to influence the marketing more*" (Morgunbladid, 1995). Furthermore, Ossur experimented with moving silicone production to the United Stated, but that proved to be too costly and the production was moved back to Iceland in the late nineties.

Internationalisation through foreign acquisitions started in 2000. That year, two Swedish distributors of prosthetic products, PI Medical AB and Karlsson & Bergström AB were acquired and united under the name of Ossur Nordic AB. Furthermore, two US companies became part of Ossur, Flex Foot Inc and Century XXII Innovations, Inc. Flex foot was specialised in feet and Century XXII in knees so both contributed to the company's more complete capacities in prosthetics.

In 2001, the decision was taken to broaden Ossur's scope of products and redefine the company as "an international company in healthcare sector". The aim was to open up new possibilities for the company's growth. In 2003, the first acquisition to meet this goal was actualised when Ossur bought the American company Generation II that was specialised in orthetics. In July 2005, another American company, Royce Medical Holding, was acquired in the same vain. In an interview with Morgunbladid in September 2005, Árni Alvar, Ossur's director of sales and marketing said that the acquisition to be an extremely important step in ensuring the continuous growth of Ossur, in particular because of Royce's large size and its access to other companies and specialists in the health field. He said that the acquisitions would aid Ossur in its marketing of other products (Morgunbladid, 2005). In 2005 and 2006 Ossur acquired four other companies, two specialised in design and manufacturing of orthotic products and two in distribution

of orthopaedics. In 2006, Ossur's subsidiaries abroad were eleven, situated in Canada, USA, Sweden, UK, the Netherlands and Australia. By then, close to all of the revenues came from foreign markets.

Actavis Group's predecessor, Pharmaco, was founded in 1956 as a purchasing alliance of several Icelandic apothecaries. The company started its own production for the domestic market in 1960. In 1981 a separate manufacturing unit, Delta, was established and remained in the majority ownership of Pharmaco until 1992 when the ties between the two companies were severed to preclude a conflict of interest.

Delta started contemplating possibilities of expanding the sales abroad as early as 1985. Exporting started in the late eighties or early nineties, focusing on close markets in Germany, the UK and Nordic countries. It was, however, not until a decade later, in 1999, that internationalisation started with Pharmaco's acquisition of Balkanpharma in Bulgaria.

The year 1999 was also an important one for Delta. The company had been going through difficult times and a new CEO, Robert Wessman was hired. Wessman's soon realised that the only way for an Icelandic pharmaceutical to grow was to internationalise. However, at the time, few Icelandic companies had gone abroad, and Internationalisation was, by many stakeholders, regarded as a risky pursuit.

In 2001 Delta acquired a company in Malta and a year later an Icelandic pharmaceutical, Omega Farma, founded in 1990. After Pharmaco's acquisition of Delta later that same year a large Icelandic pharmaceutical had emerged. Wessman's future vision of further internationalisation was shared by the new board, that included members who had experience of international business, as well as access to the necessary financial resources.

Two years later the company's name was changed into Actavis. The purpose of the name change was to create an international generic pharmaceutical company with a single brand identity. Although manufacturing and R&D are still key features, the top-management has actively changed the focus towards a more service, market and sales-oriented company.

The generic pharmaceutical market is driven by patent expire. The market is highly competitive and therefore, it is extremely important to enter the market as soon as the patent expires or else the possibility of gaining an important market share is little. Prizes also fall rapidly after the patent expire, with the most to be gained in the first months. Until 1996 product-patents in pharmaceuticals were not allowed by Icelandic legislation. Furthermore, at that time international cooperation on patenting in Iceland was negligible so many patents were never registered there. This made it possible for Delta, and later Actavis, to start research, development and production long before the patent expire, and, in some cases, to stockpile products to be ready for the market as soon as it was possible to start the distribution. This gave the company an advantage on the market, since most competitors had to wait until the patent expire to begin the research and development

process. Early internationalisation of Actavis focused on other countries with an undeveloped patent legislation, like Malta and Turkey. Advantages based on patent regulation will decrease in the future for three main reasons. First, more patents are registered in Iceland than before. Second, most competitors have already established R&D centres in countries that allow early development of products, and third, provisions for pre-patent expiry activity, such as the Roche Bolar provision in the EU, have already been or are being adapted in many Western countries (interview with a manager at Actavis; Landsbankinn, 2004).

The early Internationalisation of Actavis was directed at markets in Eastern and Central Europe. From the start of the internationalisation it was clear that entrance into the North-American market would be important as this is the largest market for pharmaceuticals. With two important acquisitions in the US in 2005 the American market this goal was realised. One of these acquired companies had large R&D operations. Although, R&D has been performed outside Iceland for a longer time, the acquisitions in 2005 marked the beginning of large-scale internationalisation of R&D in the Group.

Recently Actavis has been investing in R&D in Iceland and opened a new R&D site in the fall of 2005. Furthermore, the managers interviewed felt that it was important to continue to keep R&D strong in Iceland, because of the patent legislation and in-house competencies.

Currently the company owns twenty-four subsidiaries in USA, Western, Eastern and Central Europe, and Asia. In the beginning the focus was on Eastern and Central Europe where the markets were growing fast. Production was based in Malta where the cost was low, the Eastern and Central Europe market was near and patent legislation allowed early development. In general, Actavis' acquisitions are strategically aimed at increasing corporate synergy, enhancing R&D capabilities and enlarging the market-coverage, both in terms of location of markets and products. The main aim of acquiring new R&D has been to expand the scope of products.

Actavis' headquarters are based in Iceland, but they are seen as a network of strategic functions that are not confined to one location. The finances are, for example, based in the UK. The executive board is what one manager I spoke to called a „virtual phenomena" in the sense that they are not tied to a specific location, but meet monthly and have weekly phone-meetings.

Motives for Internationalisation

A recent survey of the motives of nineteen Icelandic companies in Internationalisation indicated that increased profit and access to new markets was the most common reason for investing abroad (Einarsson, 2006: 10B). This is also the case for the companies in this study. However, these general motives do not explain how the companies choose where to locate their international activities.

One of the main motives in Ossur's Internationalisation, at least in the beginning, was to expand the company's capacities to the construction of a full leg, but in Iceland there was mainly knowledge of liners. Thus, Flex-foot, acquired in 2000 was specialised in the development of prosthetic feet and Century XXII, acquired in 2003, of prosthetic knees. In addition to being located in the United States, which is an important market for Ossur, it was essential that these acquired companies have the expertise Ossur was looking for, in order to expand the company's product line. In-house knowledge of the acquired companies was thus a significant factor in the localisation choices.

The main motive for the internationalisation of Delta and Pharmaco (Actavis) in the late nineties and early 2000's was securing the future of the business in a increasingly competitive environment. With the acquisition of the Bulgarian Balkanpharma (Pharmaco before the merger with Delta) in 1999 and Serbian Zdravlje in 2002 the company seized new possibilities that emerged with the privatisation of these formerly government-owned companies. Delta's first acquisition abroad was Pharmamed in Malta, where patent legislation allowed early development and manufacturing of patented pharmaceuticals. In the mid-2000's acquisitions are aimed at expanding the market or acquiring competencies to develop new products.

The challenges of learning globally

In both of the case companies innovation is seen as a core activity incorporated into all of the companies' functions. Innovation activity was, thus, not "placed" anywhere in particular within the company, although some locations were clearly defined as more "strategic" than others and seen as having enhanced capacities for innovation. In fact, the term "innovation" was not often used in the interviews, but rather taken-for-granted that innovation was a part of keeping ahead in a competitive environment. One manager admitted that the interview itself had provoked thoughts about innovation: *"When you called to ask for my participation in this research, I immediately thought: why does she want to talk to me about innovation? I know nothing about innovation. But of course that's not true. Of course we innovate all the time. We just don't call it that"* (manager at Actavis).

Thus, for the case companies, innovation is something that is seen as part and parcel of the business itself. In the words of a manager at Ossur: *"It's not just some technical department or R&D department that is really creative. It's not at all cut into different departments. So the company culture – everywhere in the company – must be creative, not just because with a creative culture more people participate [in innovation] but also because it attracts customers and good employees, who think like that too. Nobody in our company believes that innovation only happens in the R&D department."*

In both case companies there was an organisational challenge of transforming information and experience into knowledge that was likely to result in innovation, or more precisely put – from their point of view – competitive advantage. As both companies had just recently internationalised, and were doing so in a rapid pace, they

were both, in different ways, caught up in the paradox of the multinational corporation pointed out by Forsgren (1997: 72): "The greater the variation in the different subsidiaries' business contexts, the higher the prospects for creating new knowledge somewhere within the MNC. But the greater the variation in the business contexts, the more difficult it will be to exploit this new knowledge on a more general basis." I will discuss how the case companies coped with this problem separately in the next section.

Ossur

In general, the managers interviewed at Ossur felt that the knowledge flow within the company was extremely important. They wanted employees to be open and willing to share knowledge. Employees regularly move around the company. For instance, people from the headquarters sometimes go to work temporarily at subsidiaries and vice versa, although the latter is less frequent. Employees must also be flexible and be willing to move from one desk to another, sometimes according to which project they are working on, but also to distribute knowledge in general. Thus, the sitting arrangement is usually changed at least once a year.

For Ossur, incremental innovation is dependent on an active knowledge flow between the market and R&D. Investment abroad was an important factor in keeping this knowledge pipeline clear and open: *"Before, when we were still a very small company, we were in cooperation with marketing and sales firms abroad. This worked well when we were a small company. However, as we grew, communication with the market became more difficult. We broke out of this by putting up our own offices abroad and later by acquiring companies with sales and marketing potential. Immediately, we had a much better contact with the customers. This resulted in much more dynamism."*

In recent years, the company has also changed its organisational structure in a way to encourage learning from the market. This was done by supporting close cooperation between the technical lead and product managers, who are responsible for the marketing. The technical lead are key employees at Ossur. Each technical lead is responsible for R&D in one group of products. They have, without exception, been with the company for a long time and have extensive professional knowledge and experience. A manager phrased the nature of the lead in this way: *"The technical lead is not a position, it is knowledge."*

The technical lead work in close collaboration with the product managers. The latter are specialised in the marketing of different groups of products. They are placed within the R&D department, so they work side by side with the technical lead. Furthermore, the product managers are highly mobile, paying regular visits the sales offices abroad. Their competencies are cross-disciplinary and they are required to have knowledge of individual markets as well as technical knowledge, especially because the customers are often specialists who *"don't want a manipulating salesperson. They want to get further"*. In an interview, one manager stated that it was important to have very qualified people in

the product management: *"You need knowledge and experience, or else the decision making-process becomes too slow and there is greater risk of mistakes"*.

Furthermore, product managers play an important role in building up the necessary agreement on the product's utility on the market. This is important for innovation, as one manager stated: *"The innovation must be valuable for the customer and to succeed we must come to an agreement with the market about the utility of the innovation. Otherwise, you don't want to buy it from me and I can't force you to. This agreement about the desirability and the utility of the product or service is becoming more and more important [for the business]."*

A few years ago product mangers were placed within the sales and marketing division, but were then moved into the R&D department. The managers interviewed felt that this change altered the ongoing incremental innovation and development process. With this arrangement, R&D receives constant and direct feedback from on the market. Processes have become parallel and more dynamic. The managers mentioned that the service level has improved as well; because technical lead and other technical staff are closer to the marketing process and can easily be called on to participate in the sales with their technical expertise. They believe that this kind of knowledge-flow has been essential for building up a highly innovative and dynamic company.

The R&D of prosthetics is based in Iceland and is quite centralised. There are examples of acquired R&D knowledge in subsidiaries being moved to Iceland. For example, when Flex-foot was acquired in 2000, two people from Iceland went to work at the subsidiary for a year to learn. Subsequently, the R&D of Flex-foot was moved to Iceland, because managers felt that the knowledge could be used more dynamically if placed there.

The centre of R&D of orthotics is centred in California. Its operations are more recent than the R&D in prosthetics that is centred in Iceland. Ossur intends to implicate the same organisational setup there as in Iceland.

Subsidiaries are usually linked to the headquarters by placing people who have extensive knowledge of the company there. These are usually people who have been with the company for a considerable time and thus have personal ties to the headquarters and know the company culture well.

In general, manufacturing can be standardised and easily relocated. However, in some cases manufacturing takes place in Iceland to avoid patenting. Patents require extensive and open descriptions of products and procedures; they can sometimes be easily copied and changed a little to bypass the patent. For this reason, Ossur prefers, in some cases, not to patent, but instead keep the knowledge close to home and within a group of key employees. This is possible, in particular, in cases of process innovations.

In sum, Ossur's core competencies are highly company-specialised and in general, key knowledge is tacit and acquired with experience. In recent years, the company has been

preoccupied with finding ways to encourage interaction and learning, both within and outside the firm.

Actavis

Generic pharmaceuticals are constrained by three important factors in their business. These have implications for the core competencies of companies such as Actavis. First, time is a key element for the generic pharmaceutical sector. Failure or success in the marketing of a product can, in the most extreme cases, hinge on as small time units as hours. Second, the generic pharmaceutical market is extremely competitive so constantly finding ways to reduce costs is very important. Innovation at Actavis is thus essentially process innovation, where the main aim is twofold, to gain time and reduce costs: *"Our innovation is about copying products faster than the competitors. It's about cracking the code faster. […] It's all about shortening production time and lowering costs."* Third, the manufacturing of pharmaceuticals is subject to high quality standards.

Access to competent specialists is of great importance in this context, but personal characteristics such as proactivity and ambition are also vital. With the urgency of deadlines, costs, revenues and quality, results are, in general, quantifiable. Actavis uses measurable indicators to monitor performance, such as Key Performance Indicators. Key Performance Indicators (KPIs) are metrics that quantify objectives to reflect the strategic performance of an organisation. At Actavis, they are directly linked to the budget, as well as to the system of compensations and rewards. In this way, the top management aims at reinforcing the behaviour of employees that is in sync with the strategy and the budget. Thus, it can be said that socialisation – the systematic changing of values and actions - is accomplished by means of formalisation. A fast and dynamic corporate culture, that fits the requirements of the business environment, is acquired internationally by focusing on a core group of managers distributed among subsidiaries:

"[Our key managers] all have this "blind ambition to succeed". And they just do what needs to be done. Then [they] start collecting people around [them] who also have [these qualities]. It is like a benign tumour, you just plug in the right places and little by little you get the culture [you want to get] [...]. Then you don't have to manage that much. [...] You just say: "this is the frame, this is what we expect" and if you have people with the initiative and the inner need to succeed, you don't really have to tell them how to do their job, they will find a new way. We see this every day."

Actavis' mode of organisation is portfolio. Subsidiaries are generally very autonomous, especially the marketing companies that are placed in mature markets. In fact, the autonomy of the marketing offices abroad is seen as a key element in the company's flexibility: *"We admit that we know nothing about running a business in Turkey. We say to the Turks: You do that, that's your job. In this way, we let the Turks sell to the Turks, the Russians sell to the Russians, etc"*. Moreover, in late 2005, the company's structure was changed in the way that sales, marketing and manufacturing were organised according to their geographical location to achieve a higher service-level locally and

increased co-operations between local units (Kaupthing bank, January 20th, 2006). The relationship of these subsidiaries with the headquarters is not knowledge-intensive. The Group is a financial back-up and provides a large pipeline of products as well as monitoring results. Only major marketing decisions, that also affect R&D and manufacturing, are taken centrally, with participation of local representatives.

However, R&D is quite centralised. The centre has historically been in Iceland, but after an acquisition in the United States in 2005, another core has emerged. More routinised R&D is performed in subsidiaries in Malta and Bulgaria. The managers interviewed feel the centralisation is important to maximise the value of the investment in R&D. The centre in Iceland has access to highly-qualified and ambitious scientists: *"The R&D is quicker in "cracking the code" [of patented pharmaceuticals] when this function is centralised."* Furthermore, one manager mentioned that in Iceland there was a very dynamic corporate culture that was of much value: *"Here the scientists dare go as far as possible with in the limits of the ethical [...] So we try everything. And that is why we base our R&D in Iceland, because here we have this energy and these resources, because R&D is the resource of Actavis."*

The knowledge flow within the Group is mostly in form of numbers and texts, with less needs to move people around, contrary to Ossur. For example, the R&D and sales units must communicate in order to take strategic decisions in R&D. This is done by looking at sales numbers: *"So the sales department is constantly helping [R&D] by saying: O.K. here is a list of products that sell [...]. Here are 50 products we feel have the highest potential and will sell the most. Then R&D says: O.K. of these 50 you say will sell, it is relatively easy to develop 20, so let's start with them."*

In sum, the competitive environment of Actavis requires a corporate structure that fosters dynamism, flexibility and speed. The R&D of generic pharmaceuticals involves finding quicker and less costly ways of producing a generally well established product. Thus, continuous knowledge flow from the market is not important for R&D at Actavis, contrary to Ossur. To succeed, R&D requires good scientists with the personal characteristics that fit the dynamic and fast environment of Actavis, but corporate-specific knowledge is, in general, not as essential as at Ossur. As a portfolio organisation, Actavis can maximise the company's need to learn and adapt to local markets, but the need of transporting this knowledge back into headquarters is limited.

"Internationalising" small-state advantages

Although learning to do business in an international environment was a challenge for both case companies, managers mentioned certain advantages of coming from a small country. First, managers mentioned that they had to start learning from global sources at an earlier stage than many competitor companies from other countries. A manager at Ossur, for example, pointed out that the home-market was almost none, so all market knowledge came from abroad: *"[Not having a home-market] forces us to serve different markets and take the different demands of different markets into consideration from the*

very start. It is an incredible advantage to be forced to think in this way. Some of our competitors have not been as successful, because they feel that they need to try everything at home first. But other countries have other demands and you might not be able to get the innovation through, using a model from you home country."

Second, the managers mentioned that coming from a small country, with little hierarchy and bureaucracy, they often didn't see the obstacles and complications that their foreign co workers focused on. This could result in easier access to information, quicker decision-making and less cost. A manager at Ossur took an example: *"We might have the confidence to talk to some head of insurance policy in Germany or somewhere. We don't feel it is a problem. We don't see it as different from calling some uncle of someone who is the head of insurance policy in Iceland or the head insurance doctor in Iceland."*

Third, the managers mentioned that the general entrepreneurial or innovative spirit in Iceland was an important resource in their international pursuits. In the words of a manager at Ossur: "*There is a rich innovation spirit [in Iceland], there is not organisation or company that sees itself as excluded from it and everyone feels that they are participating in innovation. It is not like this in all countries, on the contrary, some countries are far from it. This is very important for the company. It affects what kind of employees we get, both here and elsewhere. It is important for what kind of investors we get. And it is important for policy orientation of the government. If people just see innovation as a nuisance and say: why change, we've done things this way for many years? Then there is a risk that governments actually hinder innovation."* The managers of both companies mention that the feel it is important to build up a structure and communication modes abroad that incorporate this innovative dynamism they feel at home.

The domestic embeddedness of strategic functions.

Both Ossur and Actavis are single players in their domestic market and therefore are not embedded by the way of strong domestic clusters. When asked why the headquarters were situated in Iceland, three answers were repeatedly given: historical reasons, low corporate taxes (18%) and, most importantly, in-house competencies.

In its first years, Ossur developed partly because of a generous public health system where "*nothing was considered too good for the clients*". Furthermore, in the beginning years of the internationalisation the Icelandic banks served as an essential support. In an interview in the Icelandic public radio station, the CEO of Ossur, Jón Sigurdsson, stated that the banks were "*one of the main reasons why the Icelandic internationalisation has worked so well. [...] If Ossur hadn't had the Icelandic banks, that believed in us and supported us and participated in projects abroad that have succeeded, Ossur wouldn't be what it is today*". However, today the relationship with the banks is not as important and Sigurdsson says the company doesn't really see itself as belonging to any country: "*our decisions are based on where it is profitable to be*". However, after the reduction of corporate taxes in Iceland, to 18% he feels that "*Iceland is about the best country to be in*

[...] And this fact has resulted in increased operations in Iceland, for example we want our intellectual property [...] and patents to stay in Iceland and we can charge our subsidiaries for them" (Baldursdóttir, 2006).

Since the start of its internationalisation in 1999, Actavis embeddedness to Iceland has been in-house competencies and knowledge, for example of its scientists, as well as in favourable patent legislation that allows early development of pharmaceuticals. Its growth can be explained, from a macro point-of-view, by the changes in the Icelandic economy in the last years, but from a more micro point-of-view, by the commitment of its CEO, Robert Wessman, and its owners.

Thus, it can be said that in-house competencies are a major factor in the case companies' embeddedness in Iceland. Low corporate taxes are also an important factor, as well as patent law for Actavis.

Conclusion

In a short study of the internationalisation of Icelandic firms, Elmarsdóttir (2002) came to the conclusion that the recent internationalisation of Icelandic companies has strengthened their operations, including their home-based operations. This is an indication that internationalisation, with its possibilities to grow, has not had the effect of hollowing-out home operations. This is in harmony with the experience of the case study companies in this report. In the two case companies, the knowledge-intensive R&D functions have remained at home, mostly because of valuable in-house competencies. Furthermore, internationalisation has strengthened these domestic functions by opening learning pipelines between different locations. This has especially been true at Ossur, where the knowledge is tacit and a close connection to the market is very important for R&D. Furthermore, there are examples where Ossur has incorporated acquired R&D from abroad into their headquarters.

In this report, I have drawn out the characteristics of the core-competencies and the organisational structures of two Icelandic companies in order to understand in what ways they both serve as global pipelines with externalities that potentially diffuse into the domestic NIS.

Ossur's core knowledge base is generally more synthetic than Actavis. Thus, in the internationalisation phase, Ossur's management has been more preoccupied with inter-unit and cross-country learning than Actavis, which has been focused on achieving synergies to lower cost and entering the market faster. Whereas an active dialogue and short links between the markets and different units within the company is essential for Ossur, innovation is more linked to the effective use of measurable targets at Actavis. Thus, although this does not apply for a part of the R&D work at the company, Actavis' innovation is essentially focused on improving processes.

Herstad (in print) hypothesises that for markets where the transaction frequency is high, i.e. transactions are mainly focused on specific customers, and where the firm's market is mainly a professional market rather than a consumers market, the need for dense user-producer interaction is high and, thus, there is a great need for physical proximity to the customers. Ossur is an example of this type of a firm. Ossur's technology is immature in the sense that it is a part of emerging sectors and there is still a high rate of technological change. The link between local markets and the "core" innovative activity of the company is important.

Due to the synthetic and tacit nature of Ossur's core competencies, its gravitation nodes, especially at the headquarters, have strong pull-effects. Ossur's knowledge flows between headquarters and subsidiaries are thus complex and cyclical, whereas at Actavis they are relatively pre-defined and simple. Thus, at Ossur, knowledge must constantly flow from R&D to the market and back with the help of actual people going back and forth. At Actavis, however, the flow of knowledge is by a large part in the form of numbers and texts.

The two companies share their main centrifugal force: The extremely small Icelandic market. Both companies have mainly internationalised by acquisitions. For Actavis, the key motive for its strategy has been fast growth, by first acquiring companies with large capacities for growth and then by acquiring companies that allow for a larger geographical and product spread. Ossur's strategy has, however, been focused on increasing R&D capacities and bringing the market closer by acquiring and establishing important relationships with stakeholders.

In conclusion it can be said that the two Icelandic case study companies both represent R&D focused firms that have placed increased importance in becoming more service-oriented in the last years. They both had a relatively long history as domestic companies before internationalising, in the late 1990's, early 2000's. However, the nature of their technologies is fundamentally different, which to some extent explains their different adaptation to learning from geographically diffused sources. Despite, these differences, both companies' link to Iceland is mainly through people and their knowledge and experiences.

Denmark: Danisco, Hempel, Lundbeck, Novozymes and NovoNordisk

By Annegrete Hansen and Jørgen Lindegaard Pedersen, DTU

Introduction

The below DOMUS sub-study, aims at, with five examples of Danish multinational companies, to give some insights into these companies´ internationalisation strategies with regard to innovation, here primarily understood as R&D. (Four of the companies were interviewed). The study, on the background of the companies' R&D internationalisation motives further discuss the impact of the R&D internationalisation on the Danish innovation system and of the innovation system prerequisites for internationalisation.

R&D is a rather narrow delimitation of innovation. The reason for the narrow definition has been both operational, as well as more analytical and policy oriented. Increasing internationalisation in the form of moving sales and production activities abroad has taken place. Increasing internationalisation of R&D may follow; better understanding of the patterns and motives for this internationalisation, may point to both the benefits and the negative consequences of this development, internationally and for the national innovation systems, and thus also to the possible accompanying policies.

The companies were selected among Danish companies with substantial R&D and with R&D activities abroad. This means the representation of two pharmaceutical companies and one company with some pharmaceutical activities among the five selected companies. The food sector, which in Denmark comes second with regard to the size of the manufacturing sector's R&D with 10% of the R&D in the manufacturing sector, is not represented, primarily because we did not find indications of R&D investments abroad.

The sub-study is based on primarily annual reports and on interviews.

The interviews

Large companies with high R&D intensity have been selected for the interviews; all selected companies have substantial R&D. The five companies account for approximately 30% of private R&D; the pharmaceutical company Novo Nordisk A/S alone, accounts for about 16% of private R&D.

Though the Danish innovation system often has been referred to as characterized by small and medium sized companies basing their development on clever use of technologies developed elsewhere, industry and R&D politicians increasingly refer to R&D as potentially getting an increasing influence on innovation. Increasing industrial R&D in recent years has contributed to this assumption about increasing importance of R&D for innovation and growth.

Danish companies are also referred to as increasingly basing their innovation on foreign R&D, though Denmark as a small open economy long has depended on foreign markets for expansion, as well as having depended on knowledge from abroad for innovation. According to Statistics Denmark, 2006, concurrently 623 multinational Danish parent companies are registered, having 3680 affiliates in 2005.

A number of large companies have been representatives for the internationalisation by establishing affiliates abroad very early. Currently, however, there seems to be an additional increase in foreign direct investments in R&D abroad, emphasising that not only is the national innovation increasingly being based on formal R&D, this increase simultaneously, as a consequence or as a prerequisite requires access to foreign R&D.

This development in foreign R&D investments seems still to take place in large companies. Amongst the increasing amount of companies that in Statistics Denmark, 2006, state to plan on having R&D abroad in the future, there may be more small and medium sized companies. However, much in the existing literature touching upon investments in R&D abroad point to the large (already) multinational companies to be the ones having or establishing R&D abroad (see for example Benito et al., 2003).

Though the picture consequently is that the big multinationals dominate with regard to R&D FDIs abroad, we also looked for examples of small DOMs with R&D abroad. We did not find any. But they may exist, and could have added to the picture of how R&D FDIs contribute to the Danish innovation system and will in the future probably be more important.

This selection of companies with own R&D affiliates may have overlooked the recent tendency (after 2000) in outsourcing of innovative and R&D activities to companies abroad, which are not belonging to the same company. This development is amongst other referred by Maskell et al, June 2005 and also the R&D statistics from CFA (CFA, 1999-2005) show an increasing amount of bought R&D from affiliates not belonging to the company. If this tendency goes for large or small companies cannot be said. Two hypotheses going in each directions have been forwarded: One being that large companies with experience abroad face less uncertainty than small companies when they outsource because of their international, or even host country experience; the other being that small companies do not have the capital and resources to establish own affiliates, and therefore are more apt to prefer outsourcing than larger companies, (Narula and Zanfei, 2005).

The companies we interviewed are all from the manufacturing sector. It should be noted, however, that it seems as if Danish companies in the service and transport sector have many more people employed abroad than the manufacturing sector. According to Statistics Denmark, 2006, generally only 28% of the employees in industry's foreign affiliates are employed in the manufacturing sector, while 61 % are found in the service and transport sector.

The following table give some key figures for the interviewed companies:

	Danisco A/S	**Hempel A/S**	**Lundbeck A/S**	**Novozymes A/S**	**NovoNordisk A/S**
Industry	Food additivies	Paints	Pharma-ceuticals	Industrial Enzymes	Pharmaceuticals
Employees	9235 (2004)	3370	4993	Approximately 4000	22007
R&D employment	1000		1034	Approximately 750-800	Approximately 3630
R&D expenditure, €	74		237	103	678
Turnover, million €	2378	583.7	1298	803	4531
Employees outside Denmark	4968		3061		9683
Foreign sales		95%			99%
R&D intensity (R&D expenditure/turnover)	3		18.2	12.9	15.1
Ownership structure		Public company with majority of shares owned by J.C. Hempel Foundation		Owned by the NovoNordisk Fund	Owned by the NovoNordisk Fund

Source: Annual reports, websites and interviews.

All 5 companies have their headquarters located in Denmark, in or around Copenhagen. With exception of Danisco which have a strong part of its R&D in Aarhus in Jutland the R&D departments are also in the Copenhagen area. The concentration of headquarters and R&D in and around Copenhagen is in general, more prevalent for the chemical and pharmaceutical industries than for industry in general. A number of the large multinational companies with R&D are found in Jutland (Arla Foods, Danfoss, Grundfos, LEGO, Bang & Olufsen), but these seemingly invest less in R&D affiliates abroad and have a lower R&D intensity in general. ('Seemingly' is used to indicate, that we have not collected very rigid data for this).

A request for interview, slightly adapted to the individual company, was sent to the R&D director in 4 multinational companies in November 2005. Interviews were taken in December 2005 and January 2006, and lasted between 25 minutes (short because of

company time pressure) and 1½ hour. In all four cases the interview was taken with the addressed person (see list at the back).

The interviews followed the semi-structured project interview guide which was made to cover

- company background regarding history, ownership, localisation, production, customers, suppliers and foreign direct investments (only if supplementing annual reports or company web sites is regarded as necessary)
- explaining foreign investments and collaborations and their background
- the importance of foreign investments for company organisation
- a discussion of the importance of foreign investments/collaborations for innovation in Denmark – preferably with examples (rise or fall in innovations with background in Denmark, fewer or more collaborations in Denmark, what competences are ploughed back to Denmark, what competences are transferred to the host country, shifts in business areas etc.)

A number of surveys have given some indications of the development of R&D in Denmark and R&D in Danish foreign affiliates. Together with the referred work in chapter 1, some of the questions raised to the interview material are:

1) The general picture of eg. UNCTAD and Statistics Denmark, 2006, is that R&D investments are made in high income countries to augment the R&D of the home base, and provide the company with knowledge that the national innovation system cannot. Several surveys, eg. Statistics Denmark, 2006, foresee this to change, so that cost arguments increasingly may be a localisation factor for R&D in the future. Companies have been asked on their motivation for the location of their R&D, and specifically about where different kinds of R&D are located or are planned to be located.

2) Another argument for localisation in high income countries have in literature been advanced as market access (in a market with a certain demand). With FDI localisation for a large part being in high income countries, it is questioned from the interview material, to what extent this argument also goes for R&D localisation.

3) The argument or question about localisation in high income countries has been taken a little further, by also asking if regulation and specific market requests in the country of the affiliate have been a motivation for location near to the customers, whether business or organisational costumers or consumers.

4) The issue about if FDIs are made as asset augmenting or asset exploiting, becomes important also with regard to the effect on the national innovation system. The DI survey (DI, 2003), points to that 70 % of the companies in the survey transfer knowledge from the Danish home base to the foreign affiliates to a large or relatively large degree, whereas less, namely 50% of companies refer to

knowledge going back to the home base from the foreign affiliate to a large or relatively large extent; only app. 12% say that knowledge to a large extent is ploughed back to the Danish home base. It is thus indicated that 70% of companies are asset exploiting, whereas the 50% of companies asset augmenting to some degree.

5) Part of the R&D internationalisation discussion has taken up the issue of codification, too, in relation to both marketing, production and R&D. In DI, 2003, the way of knowledge and R&D transfer was asked, and found often to be a combination of personal transfer and codification. The personal transfer however was more dominant, than the codified form. It could be hypothesised that the asset exploiting strategy to a larger extent would use codification in the form of blue prints etc. to transfer well known procedures etc. to affiliate researchers, already aquainted with the technology, whereas the asset augmenting strategy, aiming at creating or transferring new knowledge, would require more personal, hands on education of other researchers.

Novo Nordisk A/S

http://www.novonordisk.com/

Turnover: 4501 mio. € in 2005 (33760 mio. DKK)
Employees: 22000

Novo Nordisk A/S is a merger of the two Danish pharmaceutical companies, Novo Industry A/S and Nordisk Gentofte A/S, a merger that took place in 1989. Both companies were among the largest world producers of insulin.

Nordisk Insulinlaboratorium, later Nordisk Gentofte A/S had started in 1923, Novo Teraputiske Laboratorium, Later Novo A/S two years later, when two brothers working for Nordisk Gentofte left Nordisk Gentofte and started their own production of insulin and syringes.

NovoNordisk A/S on their web site presents themselves as
'a healthcare company and a world leader in diabetes care. The company has the broadest diabetes product portfolio in the industry, including the most advanced products within the area of insulin delivery systems. In addition, Novo Nordisk has a leading position within areas such as haemostasis management, growth hormone therapy and hormone replacement therapy'.

In 2000, Novo Nordisk A/S is separated, and the industrial enzyme business carried on in Novozymes A/S.

Novo Nordisk A/S's headquarter is in Denmark, and the company employs approximately 22,000 full-time employees in 79 countries, and markets its products in 179 countries. 55% of the workforce is employed in Denmark, 15.1% (16.5%) is employed in R&D, 38.8% in production and 27%. 7% in sales (http://www.novonordisk.com/about_us/facts_and_figures/facts.asp, accessed 040506).

The company yearly spends more than half a billion € on R&D.

Lundbeck A/S

http://www.lundbeck.com

Turnover: 9,733 mio. DKK (2004)
Employment: 4,993, of which 1,932 is employed in Denmark.

Lundbeck A/S is a pharmaceutical company producing pharmaceutical products to help patients with problems in Central Nervous System (CNS). Especially in diseases as depression, schizophrenia, Alzheimer´s disease, Parkinson 's disease and insomnia.

85% of revenues come from sales in Europe and the US.

The company has sales offices, production facilities and R&D laboratories in more than 60 countries. 80% of employment is found in Europe, app. equally dived between Denmark and the rest of Europe. 20.7 % of employment is in R&D; and 43.8 % is in sales & marketing

Production (Synthesis factories) takes place in Denmark, Italy, and UK

Research is identified to take place in Denmark, headquarter and in Lundbeck Research USA, Inc.
Far the largest part takes place in Europe (see annual report, 2005/Denmark)

Clinical research is stated to take place in Denmark, Europe, Canada (http://www.lundbeck.com) and in India (interview)

Danisco A/S

http://www.danisco.com/

Turnover: 2378 mio. € (DKK17835 mio. DKK)

Employment: 9235 (2004), of which 46.2% in Denmark, Scandinavia and the rest of Western Europe, 7.7% in Eastern Europe, 14.1% in North America, 7.8% in Latin America and 13.6 in Oceania and the Pacific.

Danisco was established in 1989. But the core is the old national Sugar Company established in 1872. According to its web site *'Danisco is one of the world's leading producers of food ingredients, sugar and technical enzymes, partly produced using biotechnology'* (authors' translation from http://www.danisco.com/cms/resources/file/eb93ea452a5afbb/Danisco_DK_screen.pdf, accessed 18/11-2005). It is stated that the majority of ingredients are produced from natural raw materials. Their products are mainly used in the food industry for instance to improve the texture in bread and ice cream but are also applied to feed, cleaning, textiles and plastics.

Danisco A/S further states themselves to be one of the largest and most efficient sugar producers in Europe. The production has been based on farmer contracts; also the development of sugar beet seeds have been important, and were from early on engaged in developing genetically engineered pest resistant sugar beets.

The Danisco group employs approx. 10,000 employees in more than 40 countries and has a reported revenue of DKK 17.8 billion in 2004/05 (http://www.danisco.com/cms/connect/corporate/about%20danisco/danisco%20in%20brief/danisco_in_brief_en.htm)

The company states a considerable proportion of the employees to be engaged in research and development (1000 in 2004), and according to their web site holds 2000 patent or patent applications.

They have an active buying and selling strategy to build their business.

Novozymes A/S

www.novozymes.com

Turnover: 803.2 mio. € in 2004 (6024 mio. DKK)
Employment: app. 4000, of which half in Denmark.

Novozymes A/S a biotech-based world leader in enzymes and micro-organisms.

In 2000, Novozymes A/S demerged from Novo Nordisk A/S, which was and is a world leader in diabetes care. Enzyme production started as a side production to insulin in Novo A/S in 1939. From 1941 the enzyme trypsin was commercially extracted from the same glands as the insulin, and used in the leather industry to soften the hides.

In 1952 Novo A/S produced their first fermented enzyme, a process that has been used for enzyme production since then. In 1962 the first enzyme for detergents was marketed, and used in Biotex.

In the beginning of the eighties, Novo A/S started R&D in genetic engineering, primarily in relation to their insulin production, but with potentials also for enzyme production.In 1984, Novo A/S launched their first enzyme produced by genetically modified organisms, an enzyme for the starch industry. In 1988, genetic modification was also used for the production of a detergent enzyme. In 1987, a genetically modified insulin was brought to the market. In 1992, expression cloning was invented, which speeded up research and development, and brought new enzymes quicker to the market.

With the focus in the 1980s and beginning of the 1990s on environmental sustainability, the industrial enzymes were promoted as a technology that could reduce resource use and exploitation and which could potentially substitute unwanted chemicals. Enzymes in detergents that could reduce washing temperature and water supply, enzymes that could substitute stones and chlorine in stonewashed jeans, enzymes that could reduce chlorine and water use in paper production, enzymes that could enable more juice to be extracted from the fruits in juice production, and enzymes to enhance pigs' uptake of phosphor from feed etc.

Hempel A/S

http://www.hempel.com

Turnover: 583.7 mio. €
Employees: 3370 (2003)

The company was established in 1915. In 1948 all the assets of the company was handed over to the J.C. Hempel Foundation, which is sole shareholder of Hempel A/S. Hempel A/S owns, in full or in part, the subsidiaries of the Group.
(http://www.hempel.com/Internet/inecorporatec.nsf/8fef8e51f0b0712a0c256bf8007082b8/1eeb8a4cd0f1e826c1256fe0002389ff/$FILE/Hempel_AR_2004.pdf)

The company develops and produces marine paints, container paints and decorative paints, which are produced and sold internationally. It has invested heavily (their own wording) in innovation in recent years, and are known for addressing for example functionalities related to the environment, and different climatic conditions in development of their products. An affiliate was established in Barcelona to be able to address the warmer water and thus other conditions in the Mediterranean and have developed some of their paints in response to environmental regulation/the threat of environmental regulation.

The company has expanded its R&D in recent years, but does not give figures for the number of employees. Hempel A/S states to have 3 research centres, and 3 regional research and development functions, located in 5 different countries

Background information

Regarding market structure, all companies regard themselves as small companies in an international context, but are at the same time among the world leaders within their fields: NovoNordisk A/S in diabetes care (51% of the world insulin market measured in volume), human growth hormone and blood coagulation products, Lundbeck A/S in antidepressives, Novozymes A/S and Danisco A/S in industrial enzymes, and Hempel A/S within marine paints, including container paints.

The pharmaceutical companies, NovoNordisk A/S and Lundbeck A/S, deliver products and treatment systems for prescribed drugs, and sales go through doctors and health care systems. Both companies refer to close cooperation with doctors and health care systems on the development of the drugs and the delivery systems.

The other 3 companies – Novozymes A/S, Danisco A/S and Hempel A/S sell their products to industrial users. Novozymes A/S and Hempel A/S refer explicitly to collaboration with customers or customer contacts as important for their R&D.

Regarding the location of customers, consumers for Danish industrial products are primarily high income countries, and also for the case companies, sales in high income countries dominate. For NovoNordisk A/S, Novozymes A/S and Hempel A/S, China was reported to be a very important and increasingly important market. Some of the more specific locations are mentioned below:

NovoNordisk A/S had the major share of its total sales in Europe, followed by the US, International operations, and Japan and Oceania. About 70% of NovoNordisk A/S turnover is within insulin, and in China NovoNordisk A/S has 60% of the market in volume.

Lundbeck A/S has sales offices in 41 countries. Europe is far the largest market with 56% of sales, and the US comes second with 29%. In 2002, 80% of Lundbeck A/S's products addressed depression, products primarily addressing diseases treated in the high income countries. Also the new products for the treatment of Alzheimers disease and Parkinsons are diseases addressed in the industrialised, high income countries.

The largest markets for Novozymes A/S are the US and China. Many of Novozymes A/S's products are developed to the markets in Western Europe and the US, but Novozymes A/S sees large potentials in developing products to the Chinese market. In addition, many of Novozymes' US and Western European costumers move production of

amongst other textiles to China, and Novozymes A/S' follow. R&D in enzymes for textile production was formerly located in the US.

Danisco A/S has sales offices and production in a large number of countries, either motivated by where customers or raw materials are.

The argument about their industrial customers increasingly being in China and the company's activities needing to follow, is forwarded by Hempel A/S, too. The major share of the world's container production takes place in China, so development of paint for these has been established in China.

Regarding ownership structure, all five countries are shareholder companies. Apart from Danisco the companies are owned and governed by funds with a strong commitment for medical development and independence of the companies . This has in part been taken as an explanation of the rather strong home-base of the companies, with headquarters and R&D base in Denmark.

Motives for internationalisation of R&D

The general picture as given in literature has been the establishment of sales offices as the first FDI initiative, followed by FDIs in production. This picture may also be seen as the main order of succession in the interviewed Danish companies and in NovoNordisk A/S, but with important nuances. The localisation of R&D in connection with production seems to be a lot less pronounced than referred to in literature. And though, in cases where localisation is referred to as related to their markets, the reasons for market nearness can be nuanced both with access to customer requests, access to regulation environment, closeness to production because of economic benefits of localising production close to the customers, and state 'requirements', wishes or incentives.

The establishment of R&D departments abroad have in general taken place after the establishment of sales, while the relation between production and R&D departments are less unambiguous.
The three most R&D intensive companies - the two pharmaceutical companies and Novozymes A/S - have a modest share of the R&D taking place abroad, and also moved R&D abroad very late.

Location of R&D departments primarily takes place in the US and Western Europe, though Singapore, China and India are regarded as new locations, and also have attracted certain R&D investments.

A couple of companies state South America as a potential site for future R&D investments, and as an increasing market. For Novozymes A/S this is especially related to energy production, including production of bioethanol.

Table: R&D employment in Denmark and abroad

	Denmark	Europe, outside Denmark	The US	Japan	China	India	Other
NovoNordisk A/S	App. 3540		21-42		60		
Lundbeck A/S	App. 1000		?				
Danisco	350	350					350*
Novozymes A/S	600		100 (+30)	35-40	50-60		
Hempel A/S	40%	20-25%**	5%		10%		15%***

*Including the US, Brazil, Mexico, Singapore, Japan, Australia and India
** Spain
*** Singapore and UAE:

Novozymes A/S has about 80% (app. 600) researchers in Denmark. Though they have been expanding mostly abroad recently, the major share of R&D is still expected to be located in Denmark. The building up of R&D within micro-organisms takes place mostly in the US. Novozymes A/S outsourcing compared to FDIs in R&D is estimated to be between 5 and 8% of their R&D.

Danisco A/S refers to 1/3 of R&D taking place in Denmark, 1/3 in the rest of Europe (Finland, the Netherlands, the UK, Germany, Belgium and France) and 1/3 in the rest of the world. It has thus more employees in research outside Denmark, and has far the largest share of the R&D taking place abroad of the interviewed companies. Very few of the FDI are green field investments. They outsource to a very limited extent, and mostly very specific projects.

In general, Hempel A/S's FDIs are made close to the markets. Compared to the pharmaceutical industry, production costs are important, but there is still limited export from low income countries to high income countries. However, because container production is located in China because of low costs, the paint production is also located here. The application and area specific oriented R&D is located in abroad, whereas more general applicable R&D, including R&D in sustainable paints and speed processing R&D, are located in Denmark and Spain. Only 4-5% of Hempel A/S's sales are in Denmark.

The dominating motive for establishing R&D abroad, especially for the pharmaceutical companies (Lundbeck A/S and NovoNordisk A/S) and for Novozymes A/S, is for to get access to scientific knowledge, not available in Denmark or for to get access to knowledge for which there is a shortage in Denmark. Especially for the pharmaceutical companies, the knowledge requested is knowledge adding to the knowledge they have within specific areas. The motives for Hempel A/S (marine, industry and decorative paints) have been different. Here the motives have been a combination of test opportunities, and the importance of getting information about customer and regulatory requests.

Though the companies, with NovoNordisk A/S as the most explicit in their internet information (http://www.novonordisk.com/images/about_us/history/history_uk.pdf) state international knowledge to have been very important for their technology development, the establishment of R&D affiliates abroad takes place relatively late.

In NovoNordisk A/S sales was established in South Africa in 1959, in Norway in 1965 and 1974, in Switzerland in 1968, in 1971 in Sweden, in 1972 in Finland, in 1973 in Germany, and a lot of European countries followed with sales offices in the following years.

Though NovoNordisk A/S states to have started production in France as early as in 1959, the next investments are given as having taken place much later. In Japan production is stated to have been initiated in 1980, in the US in 1991 and 2005, in China in 1994, in Brazil 2002 and in Mexico in 2004.

R&D abroad is referred to be established rather late: In China in 2002 (according to www.mediconvalley.com, China was the first R&D affiliate abroad) and in the United States in 2005 (NovoNordisk A/S, 2005). R&D collaborations are found to take place with a number of American companies and institutions from the 1980s, and R&D has further been carried out with the associated companies ZymoGenetics Inc. since 1988 and Daco A/S since 1992.

More specifically, R&D was initiated in China to expand NovoNordisk A/S's knowledge in bacterial expression of recombinant proteins and in protein chemistry (www.mediconvalley.com). The R&D Centre in North Brunswick, New Jersey in the US, has been established 'to provide additional scientific support for building the company's haemostasis business'. In a press release it says that 'Researchers at the facility will investigate new therapies to prevent or stop critical bleeding, including exploration of treatments for intracerebral hemorrhage, trauma, stroke and other bleeding disorders.' Some of the motivation for the US investment has been a number of research institutions known for their excellence, and the presence of both industry and academic institutions in the area have contributed to the actual localisation in the Greater New Brunswick Innovation Zone.

In Lundbeck A/S, sales have generally been internationalised before other functions. Production takes place in three places in addition to the production in Denmark, namely Hungary, the UK and Italy. In some cases, clinical research has been established together with the sales department or as a separate affiliate.
Packaging facilities are often established in the country where the products are marketed, as an 'employment benefit' to the country or the state in the country of purchase.

Approximately 1000 of the R&D employees are employed in Denmark (Lundbeck, annual report 2005). Investments in the R&D activities abroad are very recent. For the R&D investments Lundbeck A/S both in Denmark and abroad, distinguishes between early R&D, development and testing, where the early R&D is carried out in a limited

number of locations, at the moment in Denmark, in the US from 2002 and in China from 2004-2005, whereas development is carried out in several countries in Europe, Asia and Latin America. Developments can be relatively general, or, as for example in the case of the activities in Paris, France, very specific.

Lundbeck A/S's R&D in China and in the US has been established through buying up of existing companies. It has been regarded as an advantage to buy into companies that had demonstrated their competences and which therefore had knowledge on the society and had the contacts.

In both China and the US the contacts to private and public R&D in the area has been important, and also regarding the Danish research external contacts to universities etc. is referred to be important.

For the early R&D, the main motivation for investing abroad has been access to R&D personnel not available or not available in sufficient quantity in Denmark. It is stated that when Lundbeck A/S or the industry in general is going into new areas, the critical mass in Denmark is too small. In addition, very specific qualifications are requested that Denmark may not have. So though they generally find that many things are easier, if research is kept in Denmark and carried out by candidates educated in Denmark, and can be managed from offices close by, they will probably increasingly invest in R&D abroad, compared to the R&D investments made in Denmark. The company has recently given money to establish a new R&D professorship at the Pharmaceutical University to make a small contribution to increasing the R&D in Denmark, which is stated to be a lot less prioritized than in other countries.

Novozymes A/S also mentions a different order of succession for their FDIs, in which sales or R&D comes first. Production in Denmark is largest and employs 939 (55% of employees in production), the US comes second with 386 employees, China third with 250, and Brazil and Sweden fourth and fifth with 90 and 55, respectively.

Novozymes started R&D abroad early: In the US in the 1970s (when it was still Novo), in Japan in the 1980s (when it was still Novo A/S), and in China in the 1990s (when it was NovoNordisk A/S). The motives are given to have been the access to very qualified researcher, the access to knowledge on the markets that they serve or that they want to serve.

Especially in China, the second largest potential market, a large number of new enzymes and applications are expected to be developed in response to demands that are different to the western markets. This diversity in developments is regarded as contributions to innovation and the growth of new markets.

Costs are mentioned specifically not to play any a role in the localisation of R&D, except for, for example, very labour intensive tasks, such as in their large scale laundry in China with employment of local non-academic and non-English speaking workers. Novozymes A/S dominating position on the market and their technological lead, is referred to be a

reason for the strategy of investing where qualifications were high and could bring new knowledge into the R&D. This, as referred by Novozymes A/S, is not to say that costs do not matter, but they have been able to afford a lead strategy. And the costs of attracting English speaking Chinese with the right R&D qualifications were referred to as as high and in Western Europe.

Danisco A/S started their international expansion in the 1980s, and it accelerated in the 1990s. Danisco A/S however did not go after R&D specifically, but had expansion as an explicit strategy. Sugar, within which they had substantial activities, had been foreseen to decrease in importance, and the strategy was to expand through investments in foods and ingredients.

Danisco A/S refers to acquisition companies and their knowledge as the dominating motive for their FDI in R&D. The buying up of companies is part of the strategy of becoming larger and the best within ingredients. The R&D comes with the purchase of new companies, and the R&D in these is usually embedded in the company and environment, and they are therefore attempted integrated into the existing R&D organisation rather than moved. An exception was the establishment of R&D in Brazil, which was motivated by nearness to an increasing market, where it was regarded as important to know of local food cultures, for example. The same argument has been used about R&D allocation in China and South East Asia. Costs are explicitly mentioned as not being a motive. The company is not heavy on salary, and their products add to the value of other products of which they constitute a small share.

The purchase of Genencor to some extent overlapped with Danisco A/S's knowledge on ingredients and biotechnology, but also added important competences in industrial enzymes and enzyme production.

The reason for investing in own subsidiaries compared to outsourcing is referred in the interview to be the difficulties in protecting the knowledge. The argument about access to local authorities, advanced by the pharmaceutical companies, is not referred to as an argument by Danisco A/S, neither for production, nor for R&D. They do not consider their activities as posing any risk.

Hempel A/S, started exports in 1920, 5 years after its start in 1915. In the following years production abroad was started on licenses. The establishment of R&D abroad was however not until the 1970s, about ten years later than the initiation of more systematic R&D in Denmark.

Hempels A/S's motivation for establishing R&D abroad is referred to as a mixture of access to certain knowledge and to favourable testing conditions, and as access to market and regulatory requests. The main share of R&D is carried out in Denmark, focussing on developing more environmental sustainable paint (for example the reducing of the dry matter content) and on increasing the speed of the chemical process (drying for example).

The more systematic R&D activities were started in Denmark in the 1960s and in Spain in the 1970s, and have expanded since then. The activities elsewhere are later, in China from the mid- 1990s and in Singapore from 2003. Today the R&D activities are divided between Denmark with app. 40%, Spain with 20-25%, China and Singapore with app. 10%, respectively and the rest related to the production sites elsewhere.

Hempel A/S's establishment of more systematic research and development in Spain in 1970s, was motivated by a traditional large market for their products in Spain and the possibility of testing their anti fouling the paints in warm waters and the year round.

The applied research and development departments in China, Singapore and the small application oriented activities in The United Arab Emirates and the US (and earlier in Kuwait, Portugal and France) have also been motivated with the importance of being able to have market and regulation requests fed back to production. In Singapore state support contributed to the decision of localising close to the production facilities.

Closeness to an innovation environment has been an additional factor for localisation in Denmark next to the Technical University of Denmark and close to other R&D and educational institutions. Also in Spain, the localisation in Barcelona has benefited from the closeness to various expertises on marine paints.

Outsourcing of R&D plays a modest role. An estimate is that between 5 and 8 % of R&D comes from external, mostly foreign, contracts. These contracts are made primarily with private companies, while university collaborations are to a larger extend based on mutual exchange. Joint R&D applications to public programmes with universities are regarded as too costly, and Novozymes A/S therefore hardly takes part in these any more.

Corporate organizational principles

The corporate organisational principles have been regarded as important as indications of the flows of knowledge between both the different functions in the company, the different locations of the company and also within the broader innovation systems in the individual countries and between countries.

The focus here has been a first attempt to identify indications of how the R&D flow between the companies take place and what the prerequisites for these flows to take place are, according to the interviewed companies.

This focus thus indicates that it is assumed that knowledge sharing is positive and conducive for innovation, and that exchange of knowledge is pursued by the companies. This view may be in contrast to views that regard competition between different company affiliates and between research institutions, as general drivers of innovation.

The formerly cited survey by Danish Industry, 2003, has asked about knowledge sharing between Danish companies and their foreign affiliates. Among the responding companies

in the survey, DI, 2003 find a considerable amount of knowledge going from the Danish companies to their affiliates abroad, and a lesser amount, primarily technical know how, going from the foreign affiliates to Denmark. Concurrently, the survey finds the employment in the foreign affiliates to have a higher education, to some extent explained by a lower share of employment in production in the affiliates abroad.

However, in our interviews the companies, the ploughing back of new knowledge to the Danish headquarter to a large extent is referred to as essential. this is somewhat in contrast to the general conclusion by DI, 2003, but must on the other hand be ascribed to both the selection of high tech companies and these companies' knowledge enhancing motivate for investing in R&D abroad. Especially the pharmaceutical companies and Novozymes A/S, request rather specific knowledge, not available in Denmark. Where R&D was established in connection to production to have market and regulatory requests reflected in product development, coordination with the R&D headquarter or other R&D departments were not so essential.

The companies indicate to be very engaged in finding ways of exchanging knowledge to increase mutual learning. Several of the companies stated the internationalisation of R&D as a large management challenge, involving formalisation of exchange via patents, contracts, documents etc., as well as exchange of personnel.

Lundbeck A/S referred to their initiatives regarding the exchange of knowledge of what they term early R&D. Exchange of personnel is considered very important for the exchange of knowledge, and the planning of exchange with the recently acquired Chinese affiliates was mentioned as being worked on. Special attention is given to expatriates, as many of the expatriates experienced difficulties for the families.

The examples given of personnel exchange were examples of knowledge going from the foreign affiliates to the Danish R&D department. To help the travelling of knowledge and personnel, laboratories were built alike in all locations. Also knowledge obtained from foreign university partners were mentioned to travel via personnel to the Danish R&D department.

With regard to development work and clinical testing, rather standardised procedures were stated to be used in the different locations. Exceptions to this were Japan and China, the latter basing its regulation on the US regulation 30 years ago. The localisation of clinical testing and development therefore mainly is argued with nearness to the local expertise and to ensure contact to the local hospitals.

Laboratory personnel have been reduced dramatically as a consequence of automation of many of the laboratory jobs. The discussion of exchange therefore mainly is taken as a discussion about exchange of scientific knowledge, and less about laboratory procedures, since these are automated.

Special bonuses were mentioned as being given to the foreign affiliates if living up to productivity measures. Bonuses could be up to 30% of the basic salary. In Denmark,

conditions in R&D were stated to be different, and characterised by mutual inspiring rather than competition; bonuses were therefore given to a few people whose work had been especially outstanding.

Also Novozymes A/S devote resources to the development of the research organisation, both as a consequence of the increasing size of the R&D organisation, the internationalisation the R&D organisation, and the extremely rapid expansion of technological opportunities. The increasing amount of information and data, and the ensuring of access to this data for all employees in the organisations, is an increasing management problem. Finding ways to do that is a major and increasing task in the coming years.

Currently, a corporate management group, in which primarily Danish and one American representative are members, is referred to take R&D decisions and communicate these to the rest of the R&D organisation. Other forms of organisations are and have been discussed, amongst them a few large units compared to a more decentralised structure. They have so far decided to have several smaller units and to use technology for the communication.

Small groups of managers are responsible for coordination within specific technical areas, including patenting. In addition, project teams are organised within certain products, including sales and marketing. Danes are in charge in all cases but one. It is the aim to take out patents in close cooperation with the researchers. They do not monitor where the patents are taken out, or within which areas.

They want to move people around between the R&D departments to bind people and projects together. But exchange of personnel is referred to be expensive, and the rotating activities have therefore been reduced for a while for cost reasons, but are planned to increase again. Novozymes A/S are themselves interested in discussions on how it can be done, and has participated as case company in a ph.d.-project's comparative study of how different international companies are organised and how knowledge is exchanged.

Danisco A/S refers to different strategies towards the integration of the acquired R&D affiliates. In some cases, the acquired affiliates are integrated into existing R&D organisations, for example in the case of Genencor which had R&D which was partly overlapping with Danisco's existing activities; in other cases the uniqueness of the affiliates or the perceived uniqueness of these are maintained by granting them a large degree of independence.

About 2/3 of the personnel in the R&D departments are academics. The share is generally larger in the foreign affiliates, and also the share of ph.d.'s are larger there. The technicians in R&D are primarily a Danish phenomena. It was indicated that the academics sometimes were a little too 'reading and writing reports' oriented, while the technicians knew more about what worked in practice.

Hempel A/S, as mentioned above, has its main share of R&D activities in Denmark and Spain, and recently Singapore, which also are the R&D centres with the most radical and most generally applicable innovations. The innovations in the other research centres could be regarded more as systematic and structured responses to market and regulatory requests, specific for the individual markets, and not necessarily of interest for production activities elsewhere in the world.

There is for example a rather close cooperation with large new construction ship yards abroad. In Denmark, R&D cooperates with the wind mill industry on testing and also testing within paints for yachts contributes to R&D. Closeness to public R&D institutions are also important.

Hempel A/Ss continued internationalisation and growth is stated to have increased focus on management of the operations in general. The annual report 2005, mentions some of the important initiatives as optimising the logistics and production capacity, as well as efforts to introduce the same management culture in the different subsidiaries.

The embeddedness of strategic functions

In the survey by the Confederation of Danish Industries, Danish Industry, 2003, it is stated that 60% of the companies' R&D is still carried out in Denmark. This formulation may indicate that the share of R&D in foreign affiliates may increase, an assumption also made by Statistics Denmark, 2006, on the background of the returned questionnaires to companies, in which the companies refer to expected R&D investment increases, in Denmark and abroad, but mostly abroad.

In the interviewed companies, there seem to be an even stronger embeddedness of R&D in the Danish innovation system. The main share of R&D activities in the interviewed companies is carried out in Denmark. 85% of R&D employment in the interviewed companies and NovoNordisk A/S and except Hempel A/S, is in Denmark; only Danisco A/S and Hempel A/S have the major share of their R&D employment abroad. The distribution of the R&D activities between Denmark and abroad varied with having between 30 and more than 95% of R&D in Denmark.

Some of the differences in the share of home based R&D seemingly reflects the companies' different investment strategies and thus the different motives for establishing R&D-FDIs.

A strong R&D base in Denmark was found especially in NovoNordisk A/S and Lundbeck A/S. Also Novozymes A/S has a strong base in the national innovation system with the majority of activities in Denmark, and with core competences located in Denmark. Specialised knowledge from R&D investments abroad is exchanged with the Danish company – and vice versa.

Danisco A/S referred to a less R&D focussed strategy for their FDIs, and referred to business expansions as the main FDI driver. In a number of FDIs, these business expansions however implied rather R&D intensive R&D investments, for example with regard to the acquisitions of Genencor and Cultura.

Hempel A/S may be the interviewed company with the largest share of production abroad. The R&D abroad to a very large extent address market and regulatory requests, whereas the base in Denmark (and Spain) address general and more radical innovations, for example regarding antifouling, and other environmental and process specifications.

The pharmaceutical companies refer to the national innovation system as favourable and supportive within their area without being specific. Contributing to these favourable conditions may however be a favourable R&D climate with relatively large public R&D programmes within the companies' business areas; private-public cooperation, for example in diabetes treatment; a strong environmental concern and regulation; and strong industrial competences within core technologies.

Though Hempel A/S and Danisco A/S have a larger share of R&D abroad, they both refer to language and time barriers for communication as being smaller in Denmark, and contributing to still a relatively large share of activities taking place in Denmark

The role of foreign presence for home-base corporate activities and NIS

A reason for political concern (and academic interest) in the role of R&D FDIs, has been the concern over if R&D FDIs would mean the loss of valuable knowledge because new knowledge would be generated and stay abroad, or if the national knowledge base, on the contrary would increase, because the Danish companies would be able to draw on a larger R&D base.

The interviewed companies all referred to an increase in total R&D. Of this increase the relatively largest increase had taken place abroad, and was also expected to do so in the future. All companies, however, expected R&D still to be coordinated from Denmark. Danisco A/S expressed the least importance of the Danish base though the strategic functions seemed to be very much based in Denmark.

The R&D affiliates of the interviewed companies in general plough the special knowledge of the specialised foreign affiliates back to the Danish base. Especially this seemed prevalent in NovoNordisk A/S, Lundbeck A/S and Novozymes A/S, which refer to the aquired or established foreign companies as contributing with knowledge not available in Denmark, or not available in sufficient quantity.

All the interviewed companies as well as NovoNordisk A/S, are represented in the R&D system in R&D councils, in governmental R&D counselling bodies, in the boards or

counselling functions of R&D institutes or institutions, and potentially increasingly so. New structures in the management of Universities has meant private industry representation, and R&D intensive companies are thus on the board of most universities.

The companies' access to influence R&D policy can therefore be assumed to have increased. All the companies refer to their interest in a strengthening of the Danish (natural science based) university research, but explicitly refers to a general strengthening of R&D and candidate production compared to the strengthening of specific areas of R&D.

Despite these companies' dominating position with approximately 30% of private R&D activity and increasing representation in boards and consulting bodies, all companies expressed from concern to severe critique of the Governmental R&D (total ignorance of the character and prerequisites of R&D) and educational policy for the continued development. Concerns with regard to the R&D policy were stated as the policy

- being without ambitions, regarding both extend (R&D as well as education) and organisation
- being divided between too many competing institutions obliged to increasingly compete for research grants,
- neglecting the potentials of giving incentives for developing environmental sustainable products
- focussing too much on commercialisation which requires much more and is much more costly than the Government assume

In addition, both Novozymes A/S and Danisco A/S referred to decreasing cooperation with the public sector, and Novozymes A/S also referred to decreasing cooperation in EU programmes, further leading to decreasing exchange of knowledge.

The strong research base in Denmark was also stated to be a prerequisite for acquiring, establishing and exploiting foreign R&D. Many of the companies' investments abroad were motivated by getting access to advanced R&D, requiring competences to assess the value of the foreign R&D as well as competences to be valuable partners.

And lastly, the current Government's neglect of visions regarding the development of environmentally more sustainable technologies, were scorned. Industrial experiences within development of more sustainable technologies and employees' environmental concerns as drivers of R&D, were criticised for not being mobilised and stimulated.

Sweden: NCC, Skanska and Axis Communications

By Daniel Friberg, IKED

Background and history of case companies

Axis communications was founded in 1984 by two students within the fields of technology and economics. The company is active on a highly competitive market producing network video products and print servers. Their primary market is that of surveillance equipment selling to "professional customers" meaning airports, schools, banks, communities etc. The market within this product line is huge but Axis derives its advantage through their *digital* technology as apart from the more common *analogue* technology. 95 % of their products are exported whereof 50 % to the US and 50 % divided between Europe and Japan-lead Asia. Concerning the development of R&D expenditure the next few years ahead, shares are expected to stay pretty much the same. This is due to the fact that Axis already puts aside 16.5 % in expenditure which is a sufficiently high allocation calculated to meet their needs in the future as well. Axis board stand for about 50 % of the stocks in the company with the rest spread out to the workers. The five biggest owners hold 57 % of shares as well as voting power, and the company was floated on the Stockholm stock exchange O-list in year 2000. Family ownership together with the fact that the two founders are Swedish makes Axis more home bound and there is no intention to relocalise. Foreign ownership furthermore consists of portfolio investment (6.5 %) lacking the strategic interest that a direct investment entails (passing the 10 % level of ownership).

There is definitely a strategic commitment to the region as *Ideon* in Lund is a business cluster enabling Axis to collaborate with presently five companies within certain shared technologies such as the construction of *circuit boards.* This is one reason for why Axis is very much connected to the local resource base. Another reason is the proximity to, and collaboration with, the *Lund Institute of Technology* (LTH) which provides the company with students of which some write their masters degrees within the framework, and assistance, of Axis and later become employees. These advantages clearly inhibit Axis from even considering relocating. Axis currently employs almost 400 people, due to rapid expansion, whereof approximately 100 are found abroad. AXIS has subsidiaries with offices in 16 countries, as well as cooperation with distributors, systems integrators and Original Equipment Manufacturing (OEM) partners in 70 countries. The subsidiaries are located in Australia, Canada, China, France, Germany, Italy, Japan, Korea, Netherlands, Singapore, Spain, Taiwan, UK, and the US, with sales in some 60 countries.

Skanska is today the second largest construction company in the world and was founded in 1887 and started with production of concrete which later turned into building. Ten years later they experienced their first international order. Skanska has 54.000 people

employed whereof 12.000 in Sweden. The company acts on a market of "perfect competition" as regards all developed countries, and their customers (and projects) depend entirely upon how the society is formed. In Sweden a lot of the projects (Skanska emphasises that they work on a project basis) hence go to public procurement from governmental institutions such as building bridges to Vägverket (*Swedish Roads*) but also industrial buildings of special use e.g. for paper mass production or steel melting. Skanska has furthermore been important for the development of the Swedish infrastructure.

After growing in Sweden, Skanska became seriously international in the 1950s, building on strong technical competence and adaptation to local cultures. Skanska's primary markets are Sweden, the US, the UK, Denmark, Finland, Norway, the Czech Republic and Argentina. They no longer have any projects in China, India, Africa and Russia (currently retrieving) mainly due to corruption. Before, SIDA (Swedish Agency for International Aid) worked together with Skanska in some projects which was found to be a factor improving obstacles met. SIDA however no longer sponsors any such programmes. Skanska is however involved in the 5th and 6th framework program in the EC.

Today some 23 % of Skanska's activities lie in Sweden whereas the US stand for 34 %, the rest of the countries amount to between 5 and 10 %.

The construction sector is the second biggest sector (after the care-sector) in Sweden but has very little registered R&D spending. Skanska expects their relative R&D-spending to be pretty constant (approximately 0.2 per thousand of turnover) over the coming years. However there are difficulties in measuring the R&D in the construction sector. As an example of this, the project undertaken in Hallandsåsen (building of a tunnel) doesn't have any R&D costs attached to it but a lot of innovative and creative activity has gone in to the project. There will therefore be large differences in stated R&D spending depending on individual measurement standards and policies for these types of companies, which does not mean that there is any real difference, in relative terms, concerning actual input.

The company has a broad network of professors at different universities indirectly contributing with technology and know-how which is not measured as part of Skanska's R&D. There is now a concern when it comes to R&D/product development because the construction subsidies to R&D from the government have diminished by 70 % from the 1990s and onward (and if it continues the subject might disappear altogether from the universities). This should be compared to other countries such as the UK and Finland where the governments heavily invest in university programmes and doctors degrees for construction R&D meaning that the government indirectly pays up to 90 % of the companies' R&D. If the government destroys the research structure and knowledge base, something they are partially doing by not supporting the sector, their might be reasons to move out. Skanska reportedly have a difficulty today at finding qualified engineers. VINNOVA, furthermore, supports the wood and manufacturing industry but not the construction sector.

Skanska who is located in Solna in Stockholm has no intention of leaving their current location. Although Solna being the most company dense place in Sweden and located just next to Sweden's other three big construction companies *NCC*, *PEAB* and *JM*, Skanska claims it doesn't matter where their HQ is located and that it has no impact on them whatsoever where they are. Still they are deeply rooted in Sweden with "Svenska Industrivärlden", specialising in investing in listed Nordic companies, as the biggest shareholder owning 7.7 % of shares but 26.9 % of voting power through its 15.000.000 A-Shares[21]. Svenska Industrivärlden exerts significant influence through an active ownership aiming at long term results in a range of companies where Skanska is part of its strategic investments. Other companies include Volvo, Ericsson, Sandvik, Handelsbanken, SCA, SSAB, Indutrade etc. which of course opens up for extensive networking and information exchange benefiting the companies and possibly increasing the degree of "embeddedness" in the national innovation system through providing better linkages between business entities. Foreign shareholders amount to 19.5 % of the capital and 13.3 % of the voting power and the current CEO is internationally recruited from the US.

NCC is the product of a fusion between companies JCC and ABV in 1988, themselves products of M&As. Further M&As later proceeded and since the mid 1990s they have grown organically. NCC is the second largest construction company in northern Europe, heavily focused on the Nordic countries, developing residential and commercial property projects, and building offices, industrial facilities, housing, roads, civil-engineering structures and other types of infrastructure with a turnover of SEK 45 billion and some 22,000 employees. NCC also offers input materials used in construction, such as aggregates and asphalt, and conducts paving, operation and maintenance operations in the roads sector. Around 10-15 companies in the market (main competitor is Skanska). Many people view the market as oligopoly but it is "perfect" competition, only exception is when it comes to certain tailor made work. Suppliers on the other hand, which NCC is dependent upon e.g. when it comes to concrete, have a certain oligopoly position. Actually NCC, Skanska, JM and PEAB only stand for some 17-18 % of the total bulding/construction market in the Nordic countries (and NCCs share is about 6 %). About half of their missions are to public procurement. NCC's location of customers is about 40 % in Sweden around 20 % in each of the other Nordic countries and some activities in Germany and Poland, and finally one project in S:t Petersburg in Russia. The sector is now more local (except for Skanska) and NCC used to have projects abroad but due to risk aversion have retrieved their operations and are currently terminating their project in Singapore. It is also difficult to enter into foreign markets due to different norms and clients and the own content is less, such as resources to involve newly examined students into international projects is close to zero. The number of Europeans or Nordic workers, working internationally has also decreased in the different projects. In the case of Singapore there are only 7 people from Europe/Nordic countries involved when 20 years ago it would have been around 50.

[21] The 10 biggest owners hold 17.000.000 A-Shares and 47.9 % of voting power.

The expected stability, respectively increase, in R&D is difficult to speculate about because every project is unique with more individually developed products depending on the specific case. Current R&D expenditure is around 1^{oo} of turnover but if you include product development it is around 5 %. Clearly NCC is measuring its R&D spending differently from that of Skanska who reported only 0.2^{oo} of turnover. NCC reports that there is a much broader product differentiation today than before and that definitions are difficult as the construction sector is very different from the car industry for example. There is however more specialisation now and patent applications have increased. There is more product development today than before as well with different applications within the company group. Local sub-optimation is no longer utilized, rather standardisation has proved much more successful due to lower prices.

NCC is primarily owned by Nordstjernan, which is a fourth generation family owned investment company targeting Nordic companies and aiming at long term growth. The second largest owner is Lundbergsfären. Nordstjernan is, furthermore, since 2004, the main investor in the second largest rental machinery company, Ramirent; Sirius Machinery, a packaging machinery group and GP Plastindustri, manufacturer of various types of injection moulded plastic components - three companies that together constitute an important link in the continuance of Nordtjernan's long-term development of companies. The strategic commitment to the region is strong. The company (being in construction) has "movable manufacturing and fixed products" and has to be at the location where you are operative, which in NCCs case is primarily in Sweden and almost exclusively the Nordic market. Concerning connection to the local resource base NCC takes on PhDs that are financed to 50 % by them (4-5 positions a year) which is something relatively new for the construction sector. Most of the examined PhDs go on to work within the company. They furthermore cooperate with VINNOVA with a development fund for doctorates. The company works more with engineering-education than before and sponsors a "construction school" for children as well as trying to awakening an interest for construction in schools at all levels. They are also involved in the 5^{th} and 6^{th} framework program in the EC.

There are two types of investments:

1) Building something that you thereafter sell (for example NCC bought land in Limhamn in Malmö, (South of Sweden) as a future investment)
2) Building something that has been ordered

Main investments are actually made in land possession. When constructing not much own capital is used and an advance is given for each project. Machinery is nowadays usually rented making the market more sensitive to interest rates.

At least in Sweden the construction sector has an image as being low-tech but in international comparison it is not. Concerning concrete casting for example, the Swedish cold has provided us with the technology to perform this activity under very unfavourable climate circumstances. This competence has led to an expertise in how to cast concrete during the winter in other countries, when they before did not do it at all during that season.

Table 1: Some key figures for the interviewed companies

	Skanska	NCC	Axis Communications
Industry	Construction	Construction	Network video products and print servers
Employees	54.000	21.000	390
-whereof in Sweden	12.000	10.000	300
Turnover, million €	SEK 125 billion global and 22 billion national	SEK 45 billion global	SEK 895 million
Foreign sales/Projects abroad	77% of activities abroad (whereof 34% in USA)	63% of NCC's activities lie abroad	95 % is exported
R&D intensity	Hard to estimate	Hard to estimate	SEK 147 million = 16,4 % of sales
Ownership structure	Majority votes (A-shares) owned by Industrivärlden (26.9%). Foreign ownership estimated to 19,5% of shares with 13.3% voting power	Majority votes (A-Shares) owned by Nordstjernan AB and Lundbergs (74.1%). Foreign ownership amounts to 2%	The five largest shareholders own 57% of both shares and voting power (privately and through companies). Foreign share holders hold 6.5%

Internationalisation of domestic MNC

Axis has, as a rule, internationalised through Greenfield investments because they are confident in their technology and feel they have what they need in terms of know-how and technology which is why the mode of growth is organic. The only exception is the buying of a small Danish company with two employees, named Atento, containing some useful technology. Axis is not a born global but started their expansion rather rapidly only a few years after their founding. The reason behind establishing subsidiaries abroad has been to gain market shares through competence exploitation. The necessary technology they find at their location in Sweden and they have no intention of going out to seek and try and source technology. The only exception was when they located an office in Silicon Valley in the US in order to tap in to "mobile networks"; they did not find it fruitful however and decided to terminate that unit. Axis has not internationalised any strategic resources but solely "operations", meaning sales and marketing, who then report to the HQ in Lund. At one point the office for marketing (to be considered a strategic resource) answering for global operations was relocated to the US. The US corporate culture was however not seen as compatible with that of the Axis HQ in Sweden, one reason being that they focused too much on the US market, instead of having a more global outlook. This led to the decision of moving back the office to Sweden. Production is conducted entirely by suppliers, primarily from Asia. The products are then sent to Lund for assembly and distribution. This line of logistics is in the wake of change as products are planned to be increasingly assembled and redistributed from the country/region in question where they are produced.

Skanska has only internationalised its activities through M&A. They started out growing organically in Sweden and later expanded internationally testing different markets and

buying other companies. Expanding by means of M&A has been seen (and is seen) as the only viable alternative because of the need to understand the culture they are operating in. They also know what works in the respective areas with regards to e.g. climate etc. As an example it would have been impossible to construct a Swedish house in Florida as it would have been eaten up by termites. In Finland the company structure is very hierarchical and in the UK there is a one way communication channel. Sweden is a predecessor in this respect as we have, organisational wise, a more flat structure which enables knowledge to flow more freely. The UK sponsorship of PhDs to the companies makes it an attractive location for gathering knowledge, especially since it is diminishing in Sweden. Skanska has however not bought other companies in order to gain new technology (construction techniques), instead they rely o their own product development.

Units involved in R&D are present in Sweden, the UK, Finland and Norway and the US. Skanska being in the construction sector doesn't work like other companies but do everything on a project basis. It is therefore meaningless to talk about what resources are divided on which countries, it depends entirely on what projects they are involved with currently. However a change over time can be noted regarding activities in Sweden relative to that of the UK and Finland as they are more supportive of the construction sector. An example of NCCs Nordic strategy and direction is the closing down of its office in China which they terminated and instead opened up a Chinese import office for importing equipment to Norway.

In the US they emphasise more robust and secure construction solutions and build more on existing experience. In Sweden more emphasis is placed on being effective and innovative. In the UK they are very good at risk management which is something that's been copied all through the whole organisation. A concrete example of intra organisational knowledge-flows is the copy in Colorado of the bridge in Udevalla, Sweden.

Due to the Globalisation **NCC** as well as other companies have become more national which is another effect of globalisation. NCC, just like Skanska internationalised its activities through M&As. Due to costly learning experiences with fusions they now avoid that. Nonetheless internationalisation by means of FDI has to be in the shape of M&A because of high entry barriers, such as in the form of culture even when entering into Norway and Denmark. R&D is now more internationalised than before through increased cooperation with similar companies who don't compete on the same markets, as an example NCC presently cooperates with a French construction company.

Imports become more important and these operations are therefore becoming more internationalised as suppliers are forming oligopoly situations, for example you are very restricted when it comes to burning concrete in Sweden. Otherwise affiliates abroad are very autonomous because you sell building and housing differently in different countries whereas strategy concerns are centred to the HQ. NCC furthermore considers the Swedish membership in the EU important as EU directives decide plenty of the regulations important for the industry.

Foreign activities impact on domestic (innovation) operations of MNC

The business activities conducted abroad by **Axis** are found to be complementary. The subsidiaries do not have any R&D functions although France, Japan and the US have a small technical support unit attached to their offices. The subsidiaries are independent but report to the HQ so that strategies and sales material can be adapted to the markets, this is the way in which (and type of) knowledge transfers back to the HQ in Lund. Formerly Axis has been driving the market in a "company push" model way, but is more and more going towards "market pull" so that Axis needs to adapt to new demands from the market. These impulses are collected through the subsidiaries as well as adaptations to local culture. Strategies and sales material for Japan is e.g. more tailor made to the Japanese market than to other markets. There are no plans concerning changing the organisational integration of units (other than starting assembly and redistribution directly from subsidiaries).

Foreign Affiliates are not really seen as a source of resources except for market impulses and tapping in on consumer needs/wants. Concerning knowledge transfer the HQ in Lund regularly arranges *sales, products* and *marketing training* for their subsidiaries who then visits the HQ. They also hold local conferences about distribution in the respective county. The change in this respect is that customer knowledge is increasingly important which increases the importance of tapping into that knowledge. Cooperation models and partners haven't really changed due to internationalisation but rather Axis has always been closely linked to the domestic and regional setting, although cooperation with suppliers concerning production can lead to innovation inputs.

There haven't really been any hampering factors on innovation except for external factors such as the IT bubble which might have caused a psychological pessimism. The multinationality has probably had some effect on management culture but it is difficult to name anything concrete, the corporate control anyhow remains very locally rooted with a far reaching strategy aiming at organic growth.

Skanska sees their foreign operations and strategic resources as complementary. Their affiliates are independent but subordinated to strict regulations of conduct. Skanska utilizes a best practices system and draws upon all the resources in their organisation in order to get the job done. As an example a Czech team was ordered to help out with an operation in Finland because the Swedish team would have been slower.

As regards information exchange between Business Unites (BUs) and to the HQ there is plenty of exchange. For example through the US BU Skanska found out about a plate/board that was extremely water resistant and later was imported to Sweden. In Slovakia similarly they gained knowledge of a form for casting concrete. Such information sharing is increasing and spreading more and more between the different BUs and is managed by the Project Support division. Factors hampering innovation in Sweden is, as mentioned earlier, that the research funding to the construction sector has sharply diminished.

The activities of **NCC** are likewise complementing each other. Example of complementarities: Danish NCC is very efficient at finding forms of cooperation with their clients, this is something that NCC in Sweden has learned and utilised. Another such thing is the implementation of programs for calculating lifecycle costs that were developed in Finland.

Foreign affiliates are enabled to act as a source of resources through meetings with the R&D experts, taking place meet 1 or 2 times a year, to discuss and network. One of the reasons for this is to not have to invent the wheel twice which is deemed as even more important than actually coming up with new knowledge. There is therefore a *systemic* knowledge transfer between BUs. An example of a technique that is being learned through cooperation with suppliers is how to minimize the electricity use through developing houses that consume much less energy for heating or cooling down through isolation. A lot of money was invested into building "Concept houses", which are houses built in accordance with a model that can utilize and store solar energy. In order to do this they formed a project group with ABB, IVT and some other companies.

Finally, product development is today being more emphasised, partly because governmental rules for construction is not a limiting factor.

Impacts of multinational activities in the domestic innovation environment

The impacts of **Axis** on the national innovation system extends itself to mutual learning within certain technologies, such as integrated board circuits where there is an interchange with companies such as Ericsson. Ericsson and Axis might e.g. share the interest of producing a "sound codifier" applicable to Axis when it comes to cameras and Ericsson in the case of telephones.

A certain collection of knowledge from abroad, when it comes to marketing, customers and strategies, could be overspilled indirectly but not in an intentional or significant manner. Except for collaboration with LTH Axis finances a doctor's position at the Competence Center for Circuit Design (CCCD), set up by the Swedish Agency for Innovation Systems VINNOVA and some industrial partners at the University of Lund, resulting in research results to Axis. Concerning the surrounding NIS and set up in general Axis are pretty happy with the way things are. Of course there could always be improvement e.g. if the LTH would be a world leading university such as MIT in the US that would be even better, even if LTH has a sufficiently high quality to attract leading companies as it is. More competing companies in the region could also enable an even more dynamic cluster. Producing large volumes cannot be made in Sweden due to expensiveness and are therefore conducted in Asia, primarily in Thailand and Malaysia. Smaller volumes can be produced in Sweden, however, and Axis utilises two facilities for that purpose.

Skanska e.g. builds tunnels for LKAB causing a spillover effect concerning know-how to the other involved companies contracted (that in some cases might be gathered from

other BUs). An Example of this is the power plant construction for ABB which helped develop a generator in that company as well as instruments for measuring. Other spillovers include the development of improved drilling equipment for Atlas Copco. Sandvik furthermore improved their material on the drills to be more resistant as a result of the cooperation.

An example of knowledge flows: Knowledge from Sweden was transferred to Trondheim in Norway concerning the excavation of environmentally hazardous waste. In Trondheim Skanska developed a technique for how to store the waste while excavating. This technology enabled them to take the decision not to go through with a similar project in Argentina because they knew it could not be applied to the mining industry. Knowledge flows also become inevitable when Skanska, building of a power plant in Panama, utilizes steel from Sandvik, Trucks from Volvo Machines form Atlas Copco etc. all of this international competition, of course strengthens the companies abilities even at home and is also contributing to a tougher competitive climate in Sweden thus contributing positively to the Swedish NIS. A possible negative effect is that Polish workers are used by foreign companies at much lower wages, which can result in increased competition resulting in the moving out of R&D and Innovation activities.

A type of knowledge flows to the national NIS is that of top executives being recruited from Skanska to the other construction companies such as NCC and Peab. According to Mr Tutti all the top executives in the other construction companies come from Skanska, which sets it apart from the other construction companies.

Just like NCC, Skanska focuses a lot on maintaining knowledge which is deemed just as important as creating knew knowledge, if not more important! This becomes obvious as the same mistakes happen now as happened 20 years ago.

Concerning the use of national technology and national programs: Skanska is involved in a number of national programmes, investing SEK100 million in each. The Infrastructure program has been going on since 1995 and costs SEK 600,000 per year but it is soon to be terminated. Surely knowledge flows to VINNOVA and other actors involved in the programmes do occur, however it is not certain to what extent and what kind. Programmes include *Competitive building Wood research, IT, Indoor Environment, Infrastructure, Sustainable building, Management, and Innovation.*

Another example of collaboration is the European research project Nanocrete running over three years, aiming at creating a form of concrete for roads and tunnel walls with the capability of decomposing contamination from cars. Other companies who are joined in the project and act as co-financers are for example Cementa. Organisations include VINNOVA, Tekes and the Swedish Building and Construction fund.

An example of technology from abroad that is now utilized by **NCC** in Sweden is the concept of concrete that you don't have to "shake" in order for it to become "tight and compact". This technology is a product of learning from Japan (the idea came from Japan) and is highly beneficial to avoid manual shaking which is very hazardous to the

health. Of course the spreading to the rest of the NIS can be assumed at least in the longer run. A certain technology of gluing concrete walls is also something that NCC has incorporated from input from abroad and something that has surely spread to the NIS. NCC has a tighter network and cooperation now with universities than they did before as they want to recruit the best. They also have lectures and visits etc. and collaborate with programs for doctors as well as involving professors. NCC has driven questions of deregulation, ten years ago it was forbidden to build houses higher than three stories etc.

Ministers T. Östros and P. Nuder will put money in the six key areas of VINNOVA, and the construction sector did not qualify which NCC, just like Skanska, find to be highly wrong as they are an important sector only superseded by the healthcare sector when it comes to number of employees. They need support because a strong construction sector is the foundation for many other industries such as transportation and infrastructure, and real estate. The interest from the government must increase as it is now they have withdrawn from basic research and there need to be more resources to relevant professors' titles because companies cannot by themselves employ professors. Gathering technology from abroad hence increases but not the actual building there. They scan the market for technology, conferences etc and cooperate if they find what they want e.g. manufacturer of windows which they import. Trade cooperation is more important now.

"Södra länken" a road and tunnel system constructed in Stockholm is a project where a lot of ideas were added from abroad. Lessons were e.g. learned in Boston concerning the construction plan implemented by "vägverket". Other learning procedures are e.g. GPS technology that has revolutionised the method of finding the appropriate place for construction.

Summing up words

Axis has no plans on increasing its shares in R&D expenditure because it's already so substantial. It would be more probable with a decrease if cheaper ways are found to produce the same technology or if the "air would go out of the market".

Axis doesn't see any reason to try and source technology abroad, they find that they have what they need at there current location. They once tried to tap in to mobile internet in Silicon Valley but the sourcing had no apparent results. There was also the acquisition of a very small Danish company with the direct reason of getting hold of the technology but that has been the only technology sourcing activity through M&A. Axis conducts operations in all Nordic countries but have no R&D facilities, nor have they any plan to expand R&D facilities or to close down any subsidiaries. They do however plan to expand other parts of their activities such as assembly and distribution taking place in the country of production.

Skanska's R&D-expenditure is project based and it is up to the HR division to maintain skilled engineers. Concerning international R&D-expenditure it is more a matter of better utilizing existing resources and knowledge through improved analysis concerning were the money is best spent.

Factors that would influence the company decision to increase R&D is that the R&D related to construction at the universities should increase, then Skanska could focus more on product development and platforms. Sourcing technology from abroad could happen if it cannot be found here. Skanska's motif has been to enter into other markets in order to gain market shares, they might though have gained additional knowledge about refineries for example when they acquired a company in Argentina, even though the knowledge was an indirect benefit.

NCC emphasises that R&D is more global now, some things can be bought finished from china and more energy can be placed on developing other things. There is no plan to increase spending on R&D or source it globally, and rather than expanding their activities NCC has become more Nordic oriented, which helps them maintain top quality and minimize risks. Innovation seems to increase nonetheless as there are more patent applications now than before. Some 50 % of construction investments go to heating, electricity, air conditioning etc. much more than people actually realise (making it more complex and not as low tech as might be assumed).

Conclusion

The construction sector is the second biggest sector (after the health care-sector) in Sweden but has very little registered R&D spending. However there are difficulties in measuring the R&D in the construction sector. There will therefore be large differences in stated R&D spending depending on individual measurement standards and policies for different types of companies, which does not mean that there is any real difference, in relative terms, concerning actual input. Skanska for example reports much lower expenditure but their calculations exclude e.g. inputs from universities. In any case they are not any less high-tech in their approach and activities than NCC who reports higher R&D spending. Clearly this is illustrative of different measurement methods making it close to impossible to assess the exact level of R&D input into that sector. Innovation and product development are key issues for these companies, as is the maintenance of the knowledge already achieved, which is something that cannot be measured, but that is probably more important than gaining new knowledge, as the same mistakes are still being made today as they were 20 years ago. All three companies expect to maintain their current spending on R&D/product development in the future. NCC but especially Skanska, being the most global construction company of the two, claims to have a problem finding skilled engineers and that there is a lack of support for the construction sector from the government to the universities and research institutes such as VINNOVA. This of course weakens the National Innovation System (NIS) possibly forcing out certain activities to countries like the UK and Finland who are more supportive of the construction sector, as they realise that it is not as low-tech as usually perceived, and that the sector is utterly important to the business environment as a whole, through engaging various sectors and thus yielding a considerable multiplier effect throughout society. A SEK spent on the construction sector is therefore highly rewarding in relative terms, generating a higher return on investment than in probably any other sector, as well as

stimulating cooperation between a multitude of actors, increasing embeddedness and creating linkages necessary for spillover effects.

All companies are thoroughly embedded in their NIS with Axis firmly rooted in the innovative science park *Ideon* where they collaborate with at least five other companies and get a steady supply of qualified students from the nearby University (LTH). Skanska and NCC are firmly rooted as well in the most company dense place in all of Sweden, *Solna,* but their embeddedness seems to be more national than regional and they have an extensive network with plenty of universities and companies as well as with European and Swedish programmes. They are furthermore companies that form part of an investment portfolio mainly owned by some few actors in the shape of investment firms. These firms also own considerable shares of other companies with complementary traits which undoubtedly lead to higher embeddedness still as well as effective resource allocation and diffusion of information. Foreign speculators are also cut out through the stronger voting power of the A-shares belonging to the main investors in Skanska and NCC. No such system exists within Axis.

Concerning knowledge flows from the subsidiary abroad, in turn tapping into the NIS in the host country, to the mother company at home, the answers tend to be rather vague and it's difficult for those interviewed to pin point exact transfers. Some few examples concerning contributions to the company group has been illustrated in all cases such as gaining knowledge of foreign markets and adapting sales strategies (Axis) or safety requirements and procedures for dealing with waste etc. (Construction sector) but from there to being able to pin point actual transfers to the national NIS is difficult, at least in the short run, even though all companies agree that such effects surely must occur and there are indications of this in the long run perspective.

Finland: KONE, Lamor and Neste Oil

By Juha Oksanen & Nina Rilla, VTT

Introduction

This study aims to shed light on links between the Finnish innovation system and domestic multinationals from company perspective. Internationalization, interaction and companies embeddedness in the domestic innovation environment is studied through three company cases. The study is based on existing public material on the selected companies and interviews implemented during the early 2006 with company representatives. An additional input is provided by the existing literature on internationalization of Finnish companies and a few recent studies focusing specifically on the role the multinational firms play in Finland and in the Finnish innovation system.

Multinational firm is here understood to refer any company having activities (subsidiary, plant, R&D unit, sales office etc.) with lasting interest at least one foreign country. Further, we have understood innovation related activities broadly. Often innovation activities are translated or seen more or less as synonymous with R&D. This view is, however, too narrow particularly if we look at smaller companies or companies operating in fields not known to be particularly R&D intensive. In addition, often product development carried out in small and medium sized firms is tightly intertwined with the business as a whole, and thus consequently less formalized in organizational terms (i.e. having no separate R&D units/departments). Rather we would like to follow here the definition given by Harrison and Sullivan (2000, 40) to innovation process: "all firms have their own approach and method for developing new or innovative ideas that create value. For many technology companies the innovation process is an R&D activity; service companies, on the other hand, often have a creativity department; still others rely on their employees in the field to produce innovative ideas".

The Finnish companies selected for the closer study are KONE Corporation, Lamor Corporation Ab and Neste Oil Corporation. Each company is shortly presented below. Here it is sufficient to highlight the most evident differences between the cases in their internationalization. KONE is a text book example of the gradual internationalization of business activities of a large company over long time. Further on internationalization has taken place gradually starting from geographically closest countries and proceed with time to more remote locations. Neste Oil's[22] history shows that a company's internationalization is not necessarily unidirectional process. Neste Oil has gone through a rapid growth of international activities and foreign acquisitions in the 1980s and the early 1990s. Since then, though, the firm has divested bulk of its foreign assets and

[22]The company's name has changed over the time because of the restructurings. Depending on the context Neste, Fortum Oil and Gas division, and Neste Oil are used in the text.

refocused most of activities in Finland. Lamor, in comparison to the two others is significantly smaller company, SME by definition, operates in highly international niche market. Lamor case also highlights specificities relating to internationalisation of small and medium sized companies.

Table 1. The Finnish case companies in figures (2005)

	KONE Corp.	**Lamor Corp. Ab**	**Neste Oil Corp.**
Industry	Metals & engineering	Wholesale of machinery and equipment	Chemical (oil refining and marketing)
Employees	27,238[1)]	50	4,486[1)]
Turnover, million €	3,242	20	9,974
Foreign employees	90%	40%	24%
R&D intensity	1.3% (€ 41 million)	not available	not available
Ownership structure	B shares stock listed, majority of voting right hold by one family	Privately owned, a VC company having 25% stake since 2004	Stock listed, 50,1% state owned, non-Finnish share-holders circa 35%

1) In the end of 2005.

KONE Corporation, established in 1910, is today the world's fourth largest elevator and the largest escalator manufacturer having around 10 per cent market share of the global market. The company has approx. 27,000 employees (90-95% abroad) and annual net sales € 3,2 billion (2005). Elevator and escalator manufacturing and maintenance services are globally mature business area in which consolidation is the predominant model to expand market share. This is reflected in the fact that besides of small local players globally are left only a handful of large companies competing for market shares. The most important customer groups include building owners, construction companies and facility management companies. KONE operates globally; market in Americas accounted for 22%, Asia-Pacific for 12% and EMEA (Europe, Middle East and Africa) for the remaining 66% of sales in 2005. KONE has two classes of shares — the non-listed class A shares and the class B shares which are listed on the Helsinki Exchange since 1967. The real power in the company is although historically exerted by one family. Maturity of elevator and escalator business manifests itself in R&D activities of KONE. Research done is mainly applied and new innovations are usually brought forth by established systems providers or component suppliers.

Neste Oil Corporation's predecessor, Neste Oy was founded in 1948 to secure nation's oil supply and widening Finland's industrial base. In the 1980s and the 1990s the state-owned company expanded abroad in its core business and in petrochemicals. The company was merged with IVO Oy (state-owned electricity producer and distributor) in 1998 in order to build an internationally competitive energy group, Fortum Corporation. The oil businesses were demerged from Fortum in April 2005 when the new company Neste Oil Corp. was listed on Helsinki Stock Exchange. In the end of 2005 Finnish State had 50.1% of shares, foreign institutions 34.8% and Finnish institutions and households the remaining 15.1%. Today Neste Oil is an oil refining and marketing company with net sales of € 9,974 million and 4,486 employees (2005). The company operates on professional and consumer markets and on niche markets in certain environmental friendly products such as high technology oils. Product range consists of high-quality traffic oils and high value-added petroleum products. Approximately 40% of production is exported, the most important markets by volume being Finland, Sweden, Germany, USA, and Canada. R&D activity focuses on developing clean traffic fuels (e.g. bio diesel) and on their production technologies. The company's R&D expenditure reached € 8 million in 2005.

Lamor Corporation Ab (Lamor Oy), established in 1982, develops oil spill recovery and environmental products to professional market. Company roots reach in shipbuilding and ship repair industry. Lamor has around 50 employees of which 30 in Finland. Turnover for the current accounting period is predicted to be € 20-22 million, at the moment approximately 95 per cent of production is exported. Lamor is family owned company, whose most important clients are oil companies and public authorities. At the moment approximately 95 % of production is exported, Russia being the most important export destination accounting roughly for half of the turnover. The global market of oil spill recovery products is dominated by few international operators of which Lamor is one of the most significant with around 20 % market share. Manufacturing is outsourced to subcontractor network whereas administration, sales and marketing as well as product development functions are positioned in the headquarters in Porvoo, Finland. Lamor has more than 250 international patents.

Historical background

Internationalization and transformation of Finnish companies into multinational corporations has taken place rather recently if compared for instance to Swedish companies, as pointed out by Mannio et al. (2003, 11). In the view of Ali-Yrkkö et. al. (2004, 12-13) the models emphasizing process nature of internationalization have rather well described how companies originating from small and open economies, such as Finland, have became international over time. Internationalization of Finnish firms has typically advanced stepwise manner via Sweden and Germany to other European countries and the US.

KONE

KONE provides a text book example of internationalization as gradual learning process during which the company expands its presence from culturally, economically and geographically close markets to more remote locales with accumulated experience base. The theoretical models underlining this view include notion that internationalization starts usually with export and only afterwards foreign direct investments come into the play.

In the history of Finnish industry KONE has played a pioneering role in internationalization. The company has been in the vanguard to acquire major factories and markets shares abroad and to employ foreign employees. KONE started to export elevators mainly to neighborhood countries already in the 1920s, 1930s (Herlin 1960, 89). After the World war II KONE contributed elevators, electric hoists and cranes to the war indemnity deliveries being paid to the Soviet Union. These contributions forced KONE to expand its capacity, rationalize production processes and learn to meet demanding manufacturing schedules and paved the way for subsequent visionary internationalization strategy. (Marchan-Piekkari 2003)

KONE’s efforts to build up connections to foreign markets intensified in the late 1950s when orders in domestic market diminished as a result of economic slow-down. First foreign subsidiary was founded in 1957 in Sweden. Since then KONE has typically expanded its international presence through acquisitions, first example being the take-over of substantially larger Sweden-based Asea-Graham and its Norwegian and Danish affiliates in 1968. Successive acquisitions followed one after another during the 1970s and 1980s whereas greenfield investments abroad have been exceptions. Decision to enter to a market through greenfield investment has been a 'last resort' if there have not been possibility to acquire a local company. An example of this was KONE’s decision to invest into a new plant in China in 1998 after it became clear that acquisition strategy was not feasible.

Over time KONE's production structure diversified and it became one of the world's largest hoist and crane manufacturers as well as a producer of high-tech electronic hospital and laboratory equipments. In the early 1990s when global recession had set in,

KONE's response was to divest shipboard cargo handling business, crane23, wood handling and piping systems businesses, and the steel foundry and electronic medical instruments business in course of 1993-1995. Maintenance of automatic building doors was hold within the company and given an extra boost by a few strategic acquisitions and alliances; the skills required are in many ways common to those needed in the elevator and escalator business and customer base is often overlapping. KONE also set out to strengthen its position as a worldwide elevator and escalator supplier through acquisitions, by investing in the new factory in China and through strategic alliances — Toshiba alliance being the most significant.

A new major manoeuvre was made in 2002, when KONE acquired Partek, a Finnish industrial engineering company with net sales equal to KONE figures. Partek's business areas consisting of container handling, load handling, forest machinery and tractors became to comprise KONE's Materials Handling division. However, soon after tractor and forest machine businesses were sold. The remaining activities of the division comprised of Kalmar container handling and Hiab load handling, was renamed as KONE Cargotec in January 2004. In the end of same year acquisition of MacGREGOR, a global marine cargo-flow solution and service provider, added shipboard cargo-handling onto business of the division. The reorganization was finalized in summer 2005 by splitting KONE into two separately listed companies on the Helsinki Stock Exchanges; elevator, escalator & building door service business continues to operate under the name KONE Corporation while Cargotec Corporation, established through de-merger, comprises former Kone Cargotec's business areas.

Today, KONE's local operations and services are provided through some 800 service centres worldwide in over 40 countries. Research and development is carried out by the Global R&D Centres locating in Finland, the US, Italy and China. Escalator R&D activities are centered in Germany and the US. In addition, a software development centre has been operating in India since the mid-2001. KONE has activities in other Nordic countries also, but no R&D functions. KONE's international orientation is reflected also in the foreign sales figures (well above 90%).

Familiarity with regional customers' needs and local conditions plays important role in the development and delivery of new elevators and escalators, and in provision of maintenance services which is reflected in geographical division of KONE activities. Existing building/housing stock differentiates the global elevator market segments. In Asia in general and in China in particular, the market is characterized by rapid growth and accompanied by strong demand for elevators and escalators. Presently, over 25% of the world's new elevators and half of new escalators are installed in China alone. In Europe, where situates about half of the current stock of the world's elevators and

[23] The sell-off the operations of crane division to a group of institutional investors led by Sweden-based Industrikapital and members of the crane division's senior management gave birth to KCI Konecranes. Today, the KCI Konecranes is with it's 5000 employees a globally operating engineering group specialising in advanced overhead lifting solutions and maintenance services. The corporate headquarters of KCI Konecranes locate in Hyvinkää — in the same town where KONE has major activities including production and R&D center.

escalators, renovation and modernisation of existing housing stock constitutes a sizeable share of local elevator market. In line with this fact the services account for a substantially larger share of KONE sales in Europe than new equipments. (KONE Annual Report 2005)

Neste Oil

Acquisitions, divestments and mergers are characterizing also history of Neste Oil, which predecessor Neste was founded soon after the World War II to secure Finland's oil supply. Ensuring national control in oil trade and refining was at that time understood to be a critical question. Neste was also conceived as a building block for industrial diversification in the country one-sidedly dependent on forest industry. During the Cold War years, Neste management alongside Finnish political elite balanced between East and West. Majority of crude oil refined by Neste was imported from the Soviet Union, whereas technologically and financially the company was relying on leading-edge American engineering know-how and large Western credit institutions. (Kuisma 1997, 338-355)

By the end of 1960s Neste had grown the largest oil refining company in the Nordic countries and by turnover second largest industrial firm in Finland. Neste adopted early on a forward looking strategy in which in-house R&D had a role to play. The first research laboratory linked with Naantali refinery was opened in 1960. In-house research centre was founded next to Porvoo refinery in 1967. (Larsio 1974)

Neste's ambitious and controversial goal in the late 1960s was to build up base for plastics industry in Finland. The company continued actively to explore opportunities in plastics industry in the following two decades and was participating in restructuring of the Nordic plastic industry. Also the scope of businesses expanded in value chain. Decision to participate in crude oil exploration and drilling in North Sea was made in the early 1970s. This was paving way to expansion of the company's oil and gas exploration and production activities not just in North Sea but in Oman, North-America and Russia in the course of 1990s and early 2000. During this phase foreign acquisitions were common. Neste commenced also activities in international crude oil trading in the 1980s. (Kuisma 1997, 361-364)

By the mid-1990s Neste had achieved a position in which it was in control of the whole oil product value chain from oil exploration to shipping, refining and retailing combined with stakes in petrochemicals and basic plastics production. The economic down-turn in the early 1990s hit hard the company, though. Neste's situation was complicated by heavy debt burden: international expansion in chemical and plastics businesses were to a large extent funded by outside capital. In addition, the political upheavals in Soviet Union in 1991 ended the bilateral trade, which was the basis for regulation of oil product imports to Finland benefiting Neste. (Kuisma 1997, 542)

Facing bleak situation Neste divested its petrochemical activities; Neste and Norwegian Statoil combined their petrochemical and polyolefin businesses into the new Borealis

Group in 1994. Neste Chemicals' units in Finland, Belgium, Portugal and Sweden were merged into the new firm. Some years later Neste sold its 50% stake in Borealis. Business activities of remaining Neste Chemicals24 were concentrated on adhesive resins and industrial coating applications to be ultimately sold to Swedish Industri Kapital in 1999. In the following year, the owner merged the acquired businesses with Norwegian based Dyno Asa to form a new company, Dynea Oy headquartered in Helsinki.

The Ministry of Trade and Industry's initiative to merge Neste with IVO, state-owned electricity producer and distributor, into a new internationally competitive energy group was approved 1997. The new company, Fortum Corporation, started in the early 1998 and was listed on the Helsinki Exchange. The combined resources of IVO and Neste and returns gained through divestment of a range of possessions (many of which previously part of Neste) provided Fortum economic resources to grow a leading energy company in the Nordic Countries and other parts of the Baltic Rim.

Having divested former Neste Chemicals activities the company — now Fortum Oil and Gas division — focused on the remaining business areas. Soon after though, because of strategic reorientation of activities, assets in oil and gas exploration and production were divested, too. Oil production assets in Oman were sold in 2002 as was oil and gas exploration and production in Norway. Divestments have been continued after the separation of Fortum oil businesses to newly founded Neste Oil Corporation in April, 2005. The company sold in autumn 2005 its 50% holding in SeverTEK to LUKOIL. SeverTEK was joint venture having license to exploration and production at an oil field in Northern Russia. Further, Neste Oil announced in early 2006 intention to sell its 10% holding in a polypropylene and gasoline component production plant locating in Saudi Arabia to SABIC, a local corporation.

After divestments Neste Oil is a pure oil refining and marketing company with own shipping fleet. The company operates on consumer and professional markets and has production facilities in Finland, Belgium and Portugal, and through two joint-ventures in Canada and Sweden — via the latter Neste is also involved in refining in the UK. Neste Oil's retail networks are at place in Finland and Baltic Rim covering St Petersburg region in Russia, Estonia, Latvia, Lithuania and Poland. Most of the oil products produced in-house are still sold on the domestic market (57% 2005) even though the export share has been growing over time. In domestic market Neste Oil's share of oil products wholesale was 77%, in retail sale of gasoline 27% and diesel 41% in 2005. The main gasoline export markets are in the other Nordic countries, Germany and North America. The main export markets for diesel fuel are Sweden and Germany, to smaller extent the other Nordic countries and other countries in Europe.

[24] Including following acquisitions: 1988 Chembond of the US, 1991 MCN of the Netherlands, 1992 Reichold's resin business in Canada, 1997 Krems Chemie GmbH of Austria and Condea resin business in Germany.

Lamor

Lamor Corporation Ab has over 20 years experience in developing and manufacturing of oil spill recovery equipment. Today it develops and manufactures for example patented oleo-philic brush skimmers, oil containment booms, transfer pumps, power packs and aluminium workboats under Lamor (LArsen Marin Oil Recovery) brand. Lamor has stayed family owned whole of its existence, at the moment 70 per cent of company is owned by family members. In 2004 an international venture capital company strengthened company's financial resources by acquiring 22.5 per cent of company shares. Lamor's senior personnel hold the remaining shares. The most important clientele for Lamor products are oil companies. In addition, ministries, harbours and other public authorities as well as private oil spill recovery companies purchase oil spill recovery equipment.

The company gained experience of oil spill recovery already early on, e.g. acting as a subcontractor for the Finnish Ministry of Environment buying oil spill recovery equipment worldwide. Lamor spotted a business opportunity on market and started to develop more innovative own products and construction of the first oil spill combatting vessel in 1986. In the midst of early 1990s economic recession and shipyard crises the company was forced to diminish operations into minimum. However, afterwards this incident proved to build some positive effects to the company. Firstly, as a result of the shipyard crises, company shifted operations exclusively to oil spill recovery technology and most of the 1990s were used for developing new innovative products. Secondly, overall scarcity led company to establish a wide subcontracting network in order to be able to supply products to customers. Only the most valuable part of operations, product development alongside of marketing and selling, was kept in-house. The model is still in use today, and has proved to be efficient and flexible.

In the beginning Lamor faced the same obstacles common to several innovative companies; the lack of references hindered commercialization of product. After company's products were tested to be the top in international comparison, credibility augmented and led to first large order from Swedish Border Guards in 1993. After completing Swedish order, company supplied oil spill recovery equipment to Baltic States and Russia jointly with Finnish Environment Ministry. First foreign companies were acquired in the early 2000s even though company has operated on international environment from start; first contacts to international trade were established already in the beginning of company history when Lamor served ex-Soviet Union customers in shipyard operations.

In 2002 Lamor acquired two competitors that improved its technical competencies significantly. Acquision of a Finnish LMP Patents Oy provided large patent portfolio, widened product range with LORI products and ended a patent dispute going back to the end of 1980s. The acquisition of British competitor, GT Pollution Technology Ltd, opened important contacts to US and Japanese markets. The participation of venture capital company strengthened Lamor's shift towards performance provider.

Lamor has evolved from single oil spill recovery manufacturer into whole oil spill recovery system specialist which offers comprehensive products to customers — i.e. not solely devices but services such as training and worldwide customer support functions. Company is determined to become a total solution provider in oil spill recovery. To this end Lamor has developed the regional Environmental Action Centres (EACs) concept. EACs established in close co-operation with local firms and authorities aim to raise preparedness to respond occurring environmental incidents quickly and effectively, and to prevent possible accidents. The first EAC, called Lamor-Yugra, was recently opened in Russian's largest oil production region in East of Ural Mountains. EAC based on public-private partnership principle operates in the supervision of Lamor who provides stockpile of oil spill recovery equipment. Furthermore, teaching, instructing and overall coordination are company's responsibilities.

Lamor has three foreign affiliates, in China, the United States and the United Kingdom. Sales offices are located in Malaysia, India and Russia, whereas distribution and sales in over 50 countries are handled via agents. At the moment approximately 95 per cent of production is exported. The domestic market for company's products is very limited, and largely saturated with Lamor's products.

Nowadays Lamor exports to over 50 countries. It has conquered some 20 per cent of world market, being a market leader with such a share. The world wide oil spill recovery market is highly concentrated, having only few large operators of which Lamor is the largest equipment supplier. The three most significant competitors are located in Norway, Denmark and the UK.

The nature of core competencies

Each company has a unique mix of competencies and even though in-house R&D is generally highly valued, its significance may well vary over time. KONE's history exemplifies how changes in a company function, like in product development are linked to changes in the company's business environment and to firm's strategy. According to Hasu (2004, 119) evolvement of in-house R&D at KONE over the past 30 years has been characterized by the transition from locally managed machine development controlled by individual pioneers to centrally managed global R&D system. In pioneering years up to 1960s product development was closely linked to management and those involved were generalists rather than specialists by approach. In-house R&D under-went expansion during the years of intensive internationalization in the 1970s and 1980s during which the R&D personnel was used to assess product and technology portfolios of the companies KONE was acquiring. The key focus of business was new, expanding markets and selection of competitive, suitable products from the existing portfolio to respective markets rather than development of new products. (ibid. 82-99)

The radical technological invention (KONE EcoDisc®) and on this based new machine room-less elevator concept (MonoSpace® elevator) elevated in-house R&D to a new role

within KONE. The innovation gave to the company competitive advantage and status of technology leader on market. KONE's core competencies in product development are comprised of a unique company specific knowledge concerning elevator systems on the one hand, and development of strategic area specific components on the other. In the latter case new technologies from outside are absorbed to in-house component development.

Neste Oil presents a company which core-knowledge is a firm-specific blend of chemistry, process technologies and specialized expertise developed in-house over the years. Particularly the know-how and technological competencies needed in Neste Oil's product development are to large extent firm-specific, whereas process technologies draw from more general knowledge base. At least to certain extent this 'specificity' of know-how needed in the product development is explained by the background of the company. In practice, Neste Oil has been only company in its field in Finland and it has had to create in-house competencies needed in development of refining technologies and oil products. In-house R&D is a characteristic distinguishing Neste Oil also from many oil refining companies abroad; having in-house developed proprietary technologies is unusual within refining business. It is more common for refineries to purchase technologies developed by specialized technology companies.

The company's own proprietary technologies are nowadays in the core of Neste Oil strategy. At highly competitive market, Neste Oil's strength is on development of cleaner traffic (bio)fuels and fuel processing technologies — i.e. the company targets those market opportunities which introduction of new products specifications and regulations opens for innovative firms. The cornerstone for in-house development of environmentally cleaner products was set in the aftermath of oil crises in the 1970s and decreasing domestic oil consumption. Decisions made in the 1980s put more emphasis on product development aiming to fulfill tightening environmental requirements (Kuisma 1997). Since then, as Hernesniemi et al. (1996) remark, the company's "effort to make environmentally superior products (...) evident in all its activities" has turned out to be one of the company's distinctive advantages.

As Lamor in 1990s had to restructure its operations, the core competences that company wished to keep in the company were formulated. At that time research and development was an obvious function to be kept in-house due to strategic focus on development of oil spill recovery equipment. More generally, the core competences of Lamor Oy are based on close customer contacts and coordination of subcontractor network. Main driver for an increase in know-how has been close co-operation with customers since the beginning — ability to listen and learn from customers is highly valued in the company. After outsourcing manufacturing to subcontractors Lamor has been able to concentrate more fully on core competencies and broadening product range.

Motives for internationalization

The major driver in internationalization of Lamor has been the superior technology compared to competitors and global scope of oil spill recovery niche markets. Another issue that has aided company's strong internationalization is wide local market knowledge. Knowing your customers and acting accordingly is essential especially on a highly concentrated and specific niche market such as oil spill recovery market. When straight customer contacts play a central role in internationalization will company's operational scope enlarge significantly. At the moment approximately 95 per cent of production is exported to tens of countries. The domestic market for company's products is very limited, and largely saturated with Lamor's products.

Mergers and acquisitions have been a way to complement Lamor's existing assets and to gain know-how and market knowledge. For instance the acquisition of a British competitor, GT Pollution Technology Ltd in 2002 brought complementing products for product range, and provided contacts to new markets, especially in Asia and the US. GT Pollution Technology Ltd's strong knowledge and know-how in oil spill response field reinforced Lamor's global position as a market leader. The acquisition of Finnish LMP Patents Ltd provided Lamor an opportunity to form a joint venture with an American partner in 2003. The acquired firm Hyde Marine Inc. acted previously as an agent for Lamor products in the Americas. The US partner had long experience of oil spill recovery business, and therefore held vast knowledge about local markets, as well as, industry as a whole. Their knowledge has strengthened Lamor's know-how in several areas.

KONE

Parallel with Lamor, the internationalization of KONE has been distinctively market driven. Through acquisitions the company has actively bought market shares and maintenance networks in international markets since the 1960's; Pekka Herlin, the long-time President, COO and the major owner of KONE, saw that small Finnish elevator manufacturer had essentially two future options; either start growing internationally through acquisitions or to be taken over by an international elevator manufacturer. Herlin and KONE chose the first alternative and since then acquisitions have had standing position in the company strategy.

The adopted strategy has fitted well together with the characteristics of elevator manufacturing and services business; the question is about globally mature business in which consolidation is the predominant model to expand market share. According to Marschan-Piekkari (2003, 152) "in the elevator industry, large volumes are a prerequisite for profitable business and value is derived from local service networks in each country". Access to these networks is the key driver for acquisitions elevator and escalator business.

This is not the whole story, though. The company has used acquisitions to acquire know-how and competences needed when establishing its presence in new or hard to conquer

markets. This is well illustrated by purchase of the fourth largest US elevator manufacturer Montgomery Elevator in 1994. Through the acquisition KONE gained not only new know-how on high speed elevators but also technology and production system fitting to the American market into which KONE had had difficulties to penetrate before. Alliance and joint-venture arrangements have also provided KONE a way to enter to new markets and a means to nurture collaboration with strategic partners. KONE has had a global strategic alliance with Toshiba Elevators and Building System Corporation (TELC) since 1998. Through the alliance, Toshiba has the right to manufacture and market elevators based on KONE's machine-room-less technology in Japan and KONE has right to use drives developed by TELC. The relationship was strengthened through cross-ownership in 2002. In this context, the President and CEO of TELC were elected to KONE Board. In 2005, the companies established an independent joint-venture for escalator production in China.

Neste Oil

From Neste Oil's history emerges two key motives for internationalization. The older one relates to expansion of activities up- and downwards in the value chain. The more recent one to utilization of in-house developed technologies on international markets. Gloomy growth prospects for the company's oil products in domestic markets in the late 1970s set tone for decisions transforming Neste gradually into an international oil and petrochemicals corporation. The management arrived at conclusion that the firm had to diversify its activities to new markets and business areas especially in petrochemicals and plastics. Expansion through foreign acquisitions was essential part of this strategy. Besides of market access, important was the access to production capacity and in-house competencies of the acquired firms.

In its core business line, being involved in the whole vertical value chain from oil production to retail was one of long-lived aspirations of the company management. Already in the early 1970s the company had decided to participate in crude oil exploration and drilling in North Sea. Decision to establish in the early 1990s Neste service station chains in the Baltic Rim region was based on opportunities identified being among the first in the emerging new markets. Development of service station chains around Baltic Sea continues to be one of the company's strategic focus areas.

Nowadays Neste Oil has concentrated on its core businesses in refining and fuels components. Key activities locate in Finland and share of operations abroad is currently significantly smaller than 10-20 years ago. Opportunities to new expansion abroad in future are, however, under consideration and possibilities to non-organic growth through acquisitions, mergers, strategic partnerships, or other corporate transactions are neither excluded. Besides of the growth of oil retail chain around the Baltic Rim, seeds for Neste Oil's future activities abroad are planted in those very areas which the product development of company has invested in last years. In practice, the company has been

looking for international partners especially in premium lubricant components and biodiesel.25

Corporate organizational principles

Questions concerning organization and management of business operations in general and foreign operations in particular are central for internationalizing firms. There is however no one-size-fits-all solution available; companies have opted for quite diverse organizational arrangements as Lovio (2004, 54-55) found out in the study on international R&D networks in the large Finnish multinational companies.

Neste Oil provides an example of a more focused company, where corporate level has significant role in R&D. Today the company has in practice concentrated all the R&D operations at the corporate technology centre in Porvoo, immediate vicinity to the company's major oil refinery in Finland. Overall, Neste Oil has been relatively integrated by its corporate structure over the history especially in relation to R&D.

Also KONE with its current structure clearly qualifies for the category of more focused companies. Over the past 10 to 15 years, the organisation of intra-company linkages and integration of foreign units in KONE's corporate structure has evolved from a loose portfolio model to model in which the foreign units are tighter integrated into the parent company. It was recognized in the late 1980s that the old organizational model was not feasible at the long run and since the mid-1990s the company has persistently aimed to standardization and harmonization of products, processes and procedures of operations. In practice, the standardization carried out has meant tightening the integration of foreign subsidiaries and consolidations and divestments at the level of foreign production plants as well as introduction of global product platforms and standardized production method for tailored elevator solutions. 'One name and one brand' policy was implemented across the organization in 1999. (Marschan-Piekkari 2003, Annual Report 2005)

With the hindsight, the machine-room-less elevator concept made at KONE's R&D centre in Finland, was not only a break-through in the global elevator business but also internally within the multinational organisation. Marchan-Piekkari (2003, 155) concludes the innovation gave a clear technological advantage for KONE on market and provided a common technological platform to the whole group, and simultaneously strengthened employees identification with the company across the corporation.

KONE has reorganised its activities into the matrix model in 2005. According to KONE's current operational principles, the local organisation is in charge of activities at customer interface, whereas global organisation is responsible for product development and operational modes as well as for common resources. The aim is to give local organisation

[25] Neste Oil has announced that it negotiates and evaluates with a number of foreign firms possibilities to jointly build production plants abroad based on the Finnish company's in-house developed proprietary technologies.

opportunity to focus on customer service, while business line directors take care of the competitive product portfolio and business infrastructure. Among others, the new model is expected to increase interaction, intra-organisational knowledge flows and awareness about different regional needs in global market areas. (KONE Annual Report 2005)

Lamor

Organizational challenges faced by Lamor, being a SME with around 50 employees in Finland and abroad, are different from larger companies. Lamor's challenge is not that much intra-firm connections and knowledge flows than orchestration of a wide network of subcontractors and key suppliers for manufacturing and logistics; Lamor has outsourced functions that are not regarded as core business to subcontractors. Only administration, sales and marketing, and product development are located at the headquarters in Porvoo.

The networking model allows flexible production that is crucial because Lamor is engaged in project trade — i.e. equipment is not produced into stock. Furthermore, production that operates on networking principle allows rapid product development projects, and is well suited to global business environment. In the beginning the subcontractor network consisted of regional companies, but with time the network has grown broader in geographical terms and includes also some foreign suppliers. The supervision of the supplier network of some 200 subcontractors proved however to be difficult and led Lamor to re-organize structure. The solution proved to be the reduction of the number of suppliers directly connected to Lamor.

Currently Lamor has 10 key suppliers which are situated close to Lamor's core processes. The key suppliers, which at the moment are all based in Finland, are regarded more or less as strategic partners who on their behalf manage several suppliers each. The expectations laid for key suppliers are higher to other companies operating in network. Periodic production requires initiative from a key supplier as it has itself several subcontractors to manage. This requires also fluent communication with customer, which means that procedures need to be well established.

Lamor uses worldwide sourcing in order to find suitable companies to join the network. In several cases, know-how is available without further development but the most suitable knowledge might take effort to find. Subcontractor network is based on mutual trust and companies are carefully selected. The network operates on few rules; firstly subcontractor has to produce high quality, and secondly the agreement has to beneficial for both parties (win-win situation). Lamor is not any subcontractor's sole customer, in practice it orders less than 50 percent of a subcontractor's production capacity. This forces subcontractors to focus on efficiency and to find their own specific advantage.

Location of 'strategic' functions

Each of the case companies is rather deeply embedded in Finland through corporate management, product development activities and links with domestic co-operators. In case of Neste Oil even during the 1980s and 1990s, when the company through foreign acquisitions and joint ventures became a multinational having activities in a number of countries, the core functions, refining and R&D were firmly concentrated in Finland. Also, majority of the company's employees has always been in Finland; 21% of personnel were abroad in 1983, around 1/3 in 1994, and 24% in 2005. In this sense development diverges from most other large Finnish companies having increasing share of employees abroad.

Neste Oil's foreign operations focus on production and sales whereas R&D activities are concentrated in Finland. The units abroad do not have any significant input into R&D carried out at the technology centre; as it seems the technology transfer within the corporation takes place uni-directionally from Finland to foreign units. The model in which R&D is centered in Finland has been in place since Neste started to expand internationally. Today, Neste Oil's refineries in Belgium and Portugal as well as the Canadian plant owned jointly with Chevron are all using technologies and components (fuel and oil additives) developed in Finland.

Neste Oil is concretely anchored in the domestic soil through its two, on international standards advanced refineries. With continuous investments the refineries have been developed over a long time "on a par with the top European refineries" (Hernesniemi et al. 1996, 137). The corporate technology centre in Porvoo employs around 100 employees in R&D and another hundred experts in quality control. In addition, at the site locates offices of Neste Jacobs Engineering, with which the technology centre closely collaborates especially in process development.26 Overall, the geographical vicinity of R&D to actual production is considered to be especially important when new products are developed, but less in relation to process development.

Location bound factors are also highly significant in terms of logistics which has an important role in oil business. Neste Oil's domestic refineries and production plants locate close to primary markets in Finland and around Baltic Sea as well as to Russian crude oil terminals from which most of feedstock used today at the refineries are shipped. North Sea oil fields have been another important origin of crude oil. The switching between different crude oil sources has required development of flexible and complex refining technologies: crude oil from the North Sea is light, demands less procession and is priced higher whereas crude oil from Russian oil fields is heavier, sourer and priced lower. Neste Oil's competitive advantage lies just here: the company has built up over years refining expertise and technologies and invested in the refineries which give it today ability to produce variety of products and cleaner traffic fuels from lower cost heavier crude.

[26] Neste Jacobs engineering is jointly owned by Neste Oil (66%) and US-based Jacobs Engineering Group Inc.

KONE

KONE's business operations comprise of two lines of activities, i.e. delivery of new elevators and escalators and maintenance services on the other.27 Nowadays some 60% of the company revenue originates from services and maintenance. Services and maintenance business is strongly location bound and "requires the company be present in all the countries that are important markets" (Lovio 2004, 25). Also manufacturing is dispersed geographically even though standardization of production processes together with introduction of global product platforms have made it possible to consolidate and divest production plants especially abroad.

In comparison to manufacturing and maintenance services, R&D activities of KONE have been internationalized to a lesser extent. The company's global R&D unit locates in Hyvinkää, Southern-Finland. Key elevator technologies are developed in Hyvinkää in cooperation with mainly domestic research organisations and partner firms. Localisation of technologies takes place in globally distributed R&D-centres and other units, which have the first-hand knowledge of local market. (Hakala 2005)

KONE's R&D-centre in Hyvinkää is responsible for the key technologies and the global R&D portfolio which is shared with the R&D centres abroad. Hyvinkää R&D centre has on the payroll approx. 150 people. In addition, in the same premises are working over 100 employees from subcontracting engineering and design firms. KONE's R&D centres abroad employ together less people in product development than Hyvinkää R&D centre alone.

The typical R&D project at Hyvinkää R&D centre involves experts from the company's R&D-centres abroad. In order to facilitate interaction common meetings are organised and ICT applications, such as e-mail and video-conferences are extensively used for communication between geographically remote units. Practical challenges in intra-company R&D projects spring from time differences and cultural specificities reflected in local business cultures. Potential ideas for new products and services are collected from all the KONE's units through intra-company software solution. Also staff mobility between the units is used for dissemination of knowledge and know-how and strengthening the linkages between units and the belonging to the concern.

KONE's R&D-centres locating outside of Finland are functionally complementing each other. The R&D centre in the US focuses on North-American market, the centre in Italy on volume products and the centre in China on local requirements. Escalator R&D is carried out in Hattingen, Germany and Moline, the US. The software development centre in India serves the whole group. In addition, development of some technologies has been subcontracted. The R&D centre in Hyvinkää collaborates mainly with Finnish partners (subcontractors, research organisations etc.) but also international subcontractors are cooperated with especially if superior understanding on local conditions, market and

[27] Maintenance services have been integral part of elevator and escalator business from the very beginning. As a historical curiosity "the elevator care-unit" of Kone Oy had more than 900 elevators to look after in Finland and more than 30 employees in1933. (Herlin 1960).

users are needed. The company's globally distributed production and R&D units have their own subcontractor networks.

The fact that large multinational elevator producer's major research and development activities are deeply embedded in the small Finnish town of Hyvinkää can be interpreted as an outcome of long historical process stretching over the last 60 years.28 Also the way in which KONE's overall internationalization has occurred weights here (cf. Lovio 2004, 47). The company's existing global R&D centres, except the centre founded through greenfield investment in China, has came into being as a 'by-product' of acquisitions of foreign elevator and escalator manufacturers.

Lovio, (2004, 47) provides another significant explanation for the concentration of KONE's key R&D activities in Finland. According to him "the extent to which company's products are based on global technologies has an effect" on share of foreign R&D: "the more similar the technology, the easier it is to concentrate R&D operations in the company's home country". As seen above KONE has since the mid-1990s standardised not only its products but also processes and procedures and thus integrated the foreign units more tightly with the corporation.

Lamor

Due to the network model adopted by Lamor, the firm's foreign activities are mainly complementing rather than substituting domestic ones. The company searches the best suited subcontractors to join the existing network regardless of location. The model developed over time mainly with Finnish subcontractors has proven to be viable even with foreign subcontractors. Lamor's key suppliers, like Factorix Oy, have contracted and orchestrate foreign subcontractors with success. Notwithstanding this the model seems although to be sensitive to prevailing business principles in different locales. Few years ago Lamor made efforts to set up in the US similar subcontracting network to use in Finland with scant results.29 Lamor turned out to be too a small customer for several potential subcontractors which by size were much bigger than the Finnish company. Also the networking principles that Lamor has built subcontracting were not suitable for local culture. As the company representatives say, "trust is understood differently in different cultures".

In the present situation, the main role of Lamor's foreign affiliates and sales offices is to connect customers and R&D functions and management located in the headquarters. Ability to listen customer preferences is one of company's strengths in which transferring information between customers and R&D personnel is highly important. For this purpose Lamor values and uses agents who have long experience of oil spill recovery industry. In the industry small affiliates possess R&D know-how through individual experts not huge R&D departments as many operators in the field are quite small in size. Motive for

[28] The elevator production was started in Hyvinkää in 1966. However, KONE had had production in Hyvinkää since 1944, when the firm's new crane factory was opened there.
[29] Initial motivation was to protect company's production and local competitiveness against potential exchange rate changes between euro and dollar.

acquiring foreign companies has often been expertise. Not to forget marketing and sales knowledge that Lamor's affiliates are able to offer. Sales contacts and channels are important for a company which exports 95 per cent of production and sells products in over 50 countries.

Lamor's embeddedness in local operational environment rely on several factors: as a family business the company has a direct link to the surrounding community; centrality of flexible network model for production together with mainly domestic collaboration partners in the company operations; and linked to trust-based relationship with network partners which takes time to root. Even though Lamor considers continuously opportunities for global sourcing, the networking model adopted by the company for manufacturing and logistics is well rooted in Finland and has turned out to be not that easy to transfer to other countries, at least not for the moment. On the other, Lamor is company constantly looking for ways to develop its operations further for instance in logistics, production and supply chain.

The role of foreign presences for home-base corporate activities and NIS

In light of the Finnish experience it seems evident that foreign operations in various forms are a prerequisite for companies coming from a small open economy in order to reach markets and customers abroad. The small domestic market does not leave much room for companies willing to grow and hence going international appears to be a matter of survival on long run. Of course, individual companies and industries are in different positions in relation to internationalization but certain current trends, such as focusing on core competencies and outsourcing as well as growing customer and user orientation, are further 'pushing' firms to look for possibilities on international markets.

Among Finnish firms foreign presence as a pipeline to knowledge sources abroad is generally valued and on attitudinal level there seems to be no hindrances tapping foreign knowledge sources. Indeed, Lovio (2004, 60) argues that Finns have been "more used to importing than exporting technology, at least in comparison with the large OECD countries". Our case studies support this argument. For instance Neste Oil's predecessor Neste used extensively foreign know-how and expertise when planning and building up its refining capacity or making decisions concerning technology sourcing/transfer and expansion of business activities. KONE has also clearly shown preparedness to absorb knowledge and technologies at place in the acquired foreign firms. For Lamor knowledge got through acquisitions of the UK and US based companies has strengthened Lamor's know-how in several areas.

In KONE case it can be argued that transformation into a multinational corporation with units all over the world has strengthened KONE's domestic operations. The corporate headquarters are in Finland and clear majority of top management is still manned by Finns — no matter the fact that the company is one of the pioneering Finnish companies

having top level foreign executives and board members. Also the company's key research and development activities have trough a long historical process deeply embedded in Finland and Hyvinkää.

The global presence and familiarity with regional customers' needs and local conditions plays important role in the development and delivery of new elevators and escalators and in provision of maintenance services which is reflected in geographical division of KONE activities. Foreign affiliates are highly important as a "front-desk" towards local customers. They have also know-how of local market taste and requirements. Innovative ideas are gathered via intranet solution from the global units.

Lamor's presence in several countries is extremely beneficial for the company. New product development is largely based on hands-on experience and direct customer response gained from oil spill recovery operations. Lamor values the co-operation with experienced agents who are able to communicate ideas back to R&D personnel as in various cases new ideas origin from customer contacts. The company participates also actively in international conferences, exhibitions and fairs. This kind of international professional gatherings provides a temporary pipeline or channel for "information exchanges between suppliers and customers about recent market trends, experiences and requirements for future products and services" (Maskell et al. 2005, 6).

One characteristic related to whole oil spill response industry is companies' close co-operation relations. For instance Lamor has formed co-operation agreement with a Norwegian competitor, NorLense AS who produces high-end oil booms. Companies' product ranges are complementing, that enables them to serve customers better together than operating individually. Forming of strategic alliances and co-operation agreements is not extraordinary but a common practice in the industry. These co-operation arrangements can be thought to play a role in knowledge transfer between the involved companies.

Neste Oil differs from the other two case companies having the major strategic assets in Finland while operations abroad concern manufacturing plants and marketing/sales offices. At the moment the units abroad cannot be considered as a vital source of new ideas for company R&D: the foreign activities are based on R&D done in Finland not vice versa. What comes to future orientation of R&D at Neste Oil, it can be anticipated that the focus on biofuels and components may require intensified cooperation with foreign actors having competences in these areas while the expertise does not exist in Finland.

Currently KONE is aiming to accelerate sales growth in fast growing economies of Asia and especially in China which is today the world's largest single market for major projects. For this purpose activities in China have been strengthened and for instance R&D operations and production has been expanded recently. In coming years the focus on developing Asian markets is likely to continue which probably is reflected also in R&D operations. On the other hand the remaining differences between national and regional elevator and escalator markets demand presence of local service provision and research and product development activities in all the major markets also in the future.

Linkages of DOMESTIC operations to DOMESTIC innovation system

All the case companies have established linkages with domestic innovation system. Many Finnish large firms, such as KONE and Neste Oil, have also a long track record about participation in national R&D programmes. Lamor has conducted product development projects largely with income financing, even though has been recently granted co-funding for its individual product development projects from Tekes, the Finnish Funding Agency for Technology and Innovation. Lamor has also used Finpro's internationalization consulting services, and obtained export credits and guarantees from Finnvera. Overall, the management of the company indicates that support to internationalization and R&D exists widely in Finland but the best assistance for company needs might be difficult to find.

KONE and Neste Oil, as flagship companies in their respective fields, have developed close co-operation with domestic universities and research institutes having expertise in areas relevant for the companies. Neste Oil's representative commented also that Finnish universities have turned out to be flexible and attentive to needs of the company. Experiences of collaboration with foreign institutions has been less encouraging in terms of flexibility and long lead times required for setting up a co-project. Early on in its history, Neste was even engaged closely in the development of domestic education and research in chemistry: a shortage of competences needed in oil refining, but also the 'societal responsibility' gave an impetus for the company to establish in 1964 Neste foundation to promote and support Finnish chemical industry as well as research and education in chemistry (Larsio 1974, 61-63). Lamor's co-operation with domestic research and educational institutions is more occasional, which may reflect firm size and characteristics of technology and business in general.

The companies studied have not experienced specific difficulties in recruitment of R&D personnel in Finland. For instance KONE's R&D centre in Hyvinkää recruits both newly graduated engineers from universities and more experienced experts from other companies. At Neste Oil the level of education in the subjects important for the company is deemed to be generally good in Finland. In spite of that it takes couple of years to a new co-worker in R&D to grasp firm-specific knowledge on which products and technologies are developed in-house. In addition, the firm-specificity of knowledge base and requirements on flexibility and swiftness in product development restrict collaboration with actors outside the company.

KONE and Lamor have recruited foreign employees also in their operations locating in Finland. Neste Oil's Technology Centre has less experience of foreign co-workers. In case of KONE, foreign staff members have been part of Hyvinkää R&D centre for a long time. The majority of the foreign experts are recruited to Hyvinkää from the other KONE units abroad, most of them being expatriates with a 2-3 years contract. The only real challenge encountered here is common to many other Finnish companies as well: it has turned out to be rather difficult to convince the best foreign experts to move to Finland.

The companies studied seem to differ markedly in intensity of cooperation with other domestic firms. Comparisons between companies domestic co-operation activity is

although difficult because in KONE and Neste Oil cases attention has been on collaboration in R&D and product development stage, not on cooperation as such. Still, inter-firm cooperation has particularly prominent position at Lamor which has outsourced not just manufacturing but also logistical functions and ‘only’ orchestrates the network together with key partners. Lamor also uses a couple of domestic R&D service providers in its product development depending on the project and resources available.

Neste Oil cooperates rarely with other Finnish companies in development of new products or processes. The company representative anticipated that in future there may well be more space and need for collaboration with domestic forest industry and some other companies with relevant and complementing know-how in areas of interest for Neste Oil. KONE R&D centre in Hyvinkää has close cooperation with a number of Finnish collaborators covering partner firms and subcontractors, universities of technologies, research organisations and alike. From the R&D unit’s perspective it is very important that collaborators locate 'next door'. Particularly intensive co-operation is with Design Center Oy, a joint-venture founded in 1999 as a result of KONE’s decision to outsource planning of special elevators. The joint-venture has offices in the same premises with KONE R&D Centre.

In Lamor’s case its first of all business know-how rather than knowledge related directly to R&D which trickles to domestic operational environment. The company’s experience of global business can be seen to spill over especially to those firms belonging to subcontractor network. Mutual learning has also occurred in the process of constructing the wide subcontractor network. Small subcontractors have gained business know-how and Lamor has been able to build a well-designed production model that suits well to global environment. From a key suppliers' point of view Lamor's international operations have brought merely positive effects. Overall understanding of requirements of international business has intensified. These not solely mean large changes in way of operating but also smaller-scale adjustments. In addition, with its international contacts Lamor offers channels for other Finnish companies operating in the environmental technologies field.

Conclusions

The case companies — as in general Finnish MNCs — internationalization has been distinctively market driven; if there is one major motive for internationalization of Finnish companies it has to be access to foreign markets. Small size of domestic markets ‘push’ firms to look for opportunities abroad. This is well illustrated by the history of KONE; decision to grow through foreign acquisitions has been for the company the way to survive in the mature elevator and escalator business. Equally important internationalization has been for Lamor focusing on highly specialized niche market in oil spill recovery technologies and services. In fact, Lamor resembles so called "Born Global” companies targeting from early on international markets and aiming to become leading international actors in their own business areas. Also in the case of Neste Oil, internationalization in the past provided a major way to expand company activities across the value chain. Today Neste Oil’s focus is on international utilization of in-house developed proprietary technologies and on growth opportunities this may provide.

In comparison, overseas R&D activities have had a secondary role to play in internationalization of the case companies — which again is common for majority of Finnish multinationals. Typically, existing R&D units abroad have harbored in the hands of Finnish MNCs as a by-product through acquisition of foreign firms. Greenfield investments in new R&D units abroad have been rare so far. By and large, technology and knowledge transfer flows have been from headquarters and R&D centers in Finland to overseas subsidiaries — i.e. companies have tended to follow the asset-exploiting strategy. Accordingly emphasis in R&D abroad has been on 'D', development and adaptation of technologies, processes and know-how originating from the parent company to local market. Today, there are clear indications that also Finnish companies with activities abroad have started recently to re-consider "their strategies and perceiving R&D activities abroad as ways to augment and acquire new assets" (cf. Criscuolo and Narula 2005, 1).

Its worth remembering, though, that from the management perspective in-house R&D is important, but not only source for growth and renewal of a company. There are various means available for the management to maintain the company's competitive advantage and for instance its stock value — i.e. the firm's core competencies may well change with time depending on perceptions of management. This, undoubtedly, has to have effect on position and significance, R&D or any other function has within the company in a certain moment. (cf. Hasu 2004, 79)

Our company cases supports findings made in several studies before concerning the strong path dependency included in location of company R&D activities. Locally embedded competencies and accumulated know-how are often tacit by nature and hard to turn into codified information and thus difficult to transfer even within a common corporate structure. Furthermore, transaction costs involved in transferring R&D activities to abroad or another domestic locale are high especially in terms of social capital, networks and co-operation arrangements developed over time with other actors in the local innovation environment.

The transfer of manufacturing to the fast growing developing economies raises although important questions concerning the future location of Finnish R&D activities. Literature and our case studies point out that there are certain complementarities between manufacturing and R&D operations; product development calls often for interaction between the R&D unit and production as well as feedback from markets. The issue is if and to what extent R&D follows manufacturing in the future. Still today many domestic MNCs have the interfaces and operations facilitating interactions needed in R&D are at place in Finland. (cf. Ali-Yrkkö & Palmberg 2006, 26-27)

Intuitively domestic multinationals as knowledge nodes and channels to global competence and know-how flows seems self-evident. However, impacts of foreign presence on companies activities on home ground and surroundings domestically are hard to grasp because foreign operations are closely entwined and natural part of firms all operations. With closer look there emerges though a number effects which can be connected to companies international operations. First, domestic multinationals provide a

model for other companies aiming on international market. Especially strong this effect is among those domestic firms co-operating close with the multinational, the latter being an ‘engine’ which partner companies and subcontractors follow abroad. It is neither unusual that (large) Finnish multinationals encourage key suppliers to locate activities in close vicinity of their own facilities abroad.

Domestic multinationals can also understood to be 'training houses' which expose the staff of the company and domestic collaborators to international competition. Accordingly, there are identifiable domestic spill-over effects related to experience of international business activities and networks. There is strong incentive for collaborating firms to progress towards standards required by the MNC. Through mobility of people international experience gained in one company ‘is transferred’ even in to larger group of domestic firms.

With historical perspective it is also clear that companies in general, and MNCs in particular are never in steady state; companies are continuously restructuring business activities not just through internal changes between units but through acquisitions, divestments, management-buy-outs, spin-offs, strategic alliances, joint-ventures, sub-contracting and outsourcing which take place both in domestic and international markets. Restructuring of domestic MNCs for instance through foreign mergers and acquisitions together with industry consolidation and divestments has in many instances led to establishment of new internationally competitive businesses (cf. KCI-Konecranes, Cargotec, Dynea, Borealis etc.).

To conclude, as the above case studies indicate companies’ strategic operations both domestic and foreign are in a constant flux. The same holds true also for status of companies’ innovation activities which differ considerably among firms and even inside a firm over time. In addition, the core of intra-company R&D and innovation activities evolve which shows in a type of R&D activities company engages abroad, and in their significance to company. The core R&D operations seems to be embedded to domestic ground while the outer layers of knowledge may spread geographically to companies’ foreign locations like rings in water.

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Nordic Innovation Centre

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The Nordic Innovation Centre initiates and finances activities that enhance innovation collaboration and develop and maintain a smoothly functioning market in the Nordic region.

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